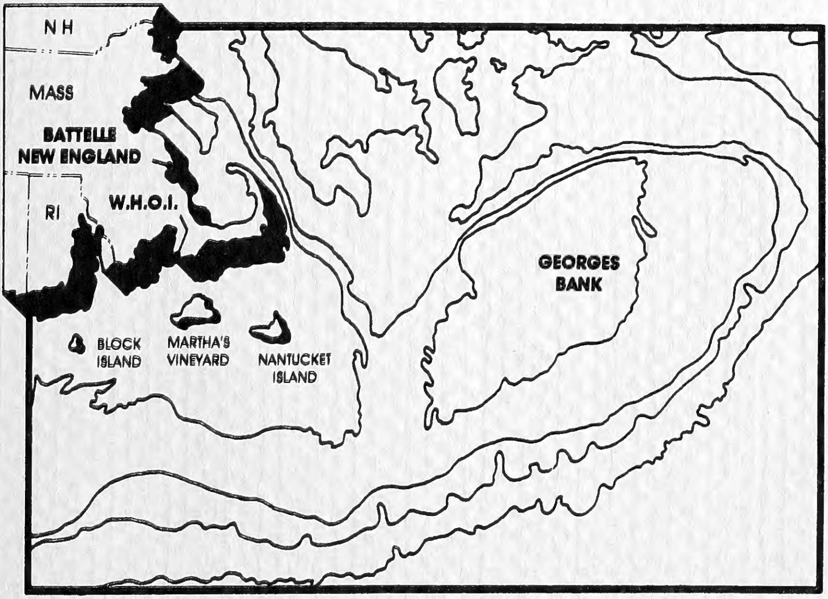
Georges Bank Benthic Infauna Monitoring Program

FINAL REPORT

YEAR 2



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GEORGES BANK BENTHIC INFAUNA MONITORING PROGRAM

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FINAL REPORT
FOR SECOND YEAR OF SAMPLING

(July, 1982 - May, 1983)

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16. Abstract Concerns about the potential effects of oil and gas exploration activities on the highly productive Georges Bank off the coast of Massachusetts led to the initiation of an intensive monitoring program in July, 1981. The program includes intensive sampling of the benthic communities, collected near, upcurrent and downcurrent of the drilling rigs, analysis of bottom photographs for epifauna and microtopography, dredge and trawl collections, CHN and sediment grain size analysis. Collections of six replicate infaunal samples at each of 46 stations are made on a seasonal basis. Samples are collected with a 0.04 m^2 modified Van Veen grab sampler and are live-sieved through stacked 500 µm and 300 µm screens. Twenty-nine stations are positioned in a tight radial array around a rig at 80 m. A second group of 3 stations are near a rig site at 140 m. The remaining stations cover a broad expanse of the Bank and nearby areas of potential deposition of drilling materials. Additional aspects of this program include a detailed life history analysis of 20 dominant benthic species, and a study which links fish feeding with benthic production. Results from the first 8 biological collections indicate little heterogeneity within stations, with good replication between samples. A strong relationship between faunal composition and both sediment type and depth is indicated by cluster analysis. Eight dry holes have been drilled to date in the Lease Sale 42 area. No biological impacts which could be attributed to drilling activities have been detected at any station, including the site-specific array in Block 312, the 3 stations near the drill rig in Block 410, or any regional station monitored in this program.

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PREFACE

The Georges Bank Benthic Infauna Monitoring Program is the lead component of a four-part program supported by the United States Department of the Interior, Minerals Management Service: The Georges Bank Monitoring Program. Other components of this program include:

> Analysis of Trace Metals in Bottom Sediments, performed by U.S. Department of the Interior, U.S. Geological Survey, Woods Hole, MA;
>
> Analysis of Hydrocarbons in Bottom Sediments and Analysis of Hydrocarbons and Trace Metals in Benthic Fauna, performed by Science Applications, Inc., La Jolla, CA.
>
> Analysis of Historic Benthic Infaunal Samples from BLM's New England OCS Environmental Benchmark Program, performed by Taxon, Inc., Salem, MA.

To the extent possible, the results of these investigations are used here as an aid to interpreting the results of the Benthic Infauna Monitoring Program.

A large number of people have contributed their talents to the Benthic Infauna Monitoring Program over the last two years. The list has grown too large to permit us to include an acknowledgement of each individual by name, but we would like to express our appreciation to everyone who has worked with us on the project. Special thanks are due to Eiji Imamura and Jeff Hyland of the Minerals Management Service for their encouragement and assistance on this program.

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1. CONCLUSIONS

1.1 General

• Biological patterns in Year 2 were basically similar to those reported in Year 1. Overall benthic community structure did not change very much with season at any station, although populations of several species fluctuated seasonally. However, at stations at or deeper than 100 m (i.e. Stas. 3, 6, 8, 9, and Block 410), the samples were sufficiently similar from season to season that it was possible to resolve subtle differences between Year 1 and Year 2.

• The large decline in the abundance of individuals and species of benthic infauna at Regional Station 13, a major depositional site, between February and May, 1982 (M3 and M4), while drilling was taking place in Lease Area 42, was not repeated between February and May, 1983 (M7 and M8). Since there was no detectable increase in concentrations of barium, petroleum hydrocarbons or other tracers of drilling discharges in the sediments of the area during or after drilling, the decline in Year 1 probably was not due to drilling activities.

• During Year 2, as during Year 1, the replicate infaunal samples from each Regional Station showed an exceptionally high degree of homogeneity. Cluster analysis demonstrated that all of the replicates of any one Regional Station were more similar to each other than to replicates from any other station. There was never a season when the benthic community of a particular Regional Station was not distinct from those of surrounding stations. When replicates from each sampling date were summed, the samples from each of the eight sampling periods fused before any separation occurred between stations. This homogeneity should enable us to detect biological changes in the benthic infauna, should they occur at these stations.

• No significant changes in benthic infaunal community structure which can be attributed to the drilling of eight dry holes on Georges Bank have been detected during and for at least one year after drilling by the methods of analysis used thus far.

1.2 Block 312

• Drilling began in Block 312 on December 8, 1981 and continued until June, 1982. At Primary Site-Specific Stations where an increase in the concentration of barium (from drilling discharges) in bulk surficial sediments was observed between Cruises M1 (before drilling) and M5 (after drilling), there was no statistical correlation between benthic infaunal community similarity parameters and increase in barium concentration between M1 and M5, or percent silt-clay in sediments. A highly significant correlation between community similarity parameters and percent fine sand was observed. Although stations within the site-specific array in Block 312 had a homogeneous community structure over most of the area, species composition is different at two stations located to the west of the rig site where the proportion of fine sand was higher than at other stations in the array. These results indicate that discharges of drilling fluids and cuttings did not have a measurable impact on benthic infauna in Block 312.

• Patterns of decline in the number of individuals per 0.04 m^2 and abundance of certain dominant species, such as the amphipods Erichthonius rubricornis and Unciola inermis, in November, 1981 (M2) or February, 1982 (M3) at stations near the rig site in Block 312, at which barium subsequently accumulated, were repeated but at a lesser magnitude in November, 1982 (M6) and February, 1983 (M7), indicating that the fluctuations are at least partly seasonal. These fluctuations can not be attributed to drilling activities.

• The apparent small accumulation of petroleum hydrocarbons in sediments at Primary Site-Specific Station 5-1 and possibly Station 5-18 (less than one-half part per million) (Payne et al., 1983), had no measurable impact on the benthic infauna of those stations.

1.3 Block 410

• Drilling occurred in Block 410 between July, 1981 and March, 1982. No measurable impact on the benthic fauna due to drilling activities has been detected after analysis of eight seasonal samples with the statistical methods used thus far.

1.4 Life History Analysis

• Results from the life-history analysis aid in interpreting observed changes in species abundance. For the three amphipod species studied, much of the variation in abundance can be explained on the basis of recruitment and mortality; other factors such as adult migration may also be important. Data on the several polychaete species studied were not as conclusive in explaining patterns of abundance, since Cossura longocirrata was the only species exhibiting a decline in population abundance which was clearly correlated with timing of reproduction. Only one species, Exogone verugera, exhibited recruitment in the winter (February), while the other species appeared to recruit primarily in the spring and summer. The majority of polychaete juveniles appeared in the summer (Table 12).

1.5 Production and Fish Feeding

• Yellowtail flounder on Georges Bank feed primarily on macrobenthic species. The dominant prey species varied seasonally and between stations. Flounder appear to accommodate changes in the abundance of their preferred prey species.

1.6 Comparison With Historic Infaunal Samples

• At Station A (40°51.0'N, 67°24.4'W, 85 m depth), bottom observations and current meters maintained by the U.S. Geological Survey from May, 1975 to March, 1979 showed effects of winter storms on bottom surface topography and provided evidence that benthic macrofaunal communities may play an important role in maintaining bottom sediment stability during a storm event (Butman, 1982). Analysis of benthic samples collected between May, 1980 and July, 1982 showed little effect of such storms on benthic macrofaunal communities. Despite the erosion of sediments and disappearance of the surface biological mat observed by Butman (1982), the benthic populations did not show a sharp decline during the 1980-1982 winter periods.

- Eleven stations sampled during the New England OCS Benchmark Study in 1977-78 coincided with stations sampled during the Monitoring Program. Analysis of these historic samples was completed by Taxon, Inc. (Michael et al., 1983). The dominant species recorded from the 1977-78 samples generally agreed with the dominant species found in Monitoring Program samples. There was particularly good correspondence for dominant species recorded at the Block 312 drilling site, Station 5-1, with seven species reported in common. Average density of individuals at the eleven stations were generally higher in the Monitoring Program samples, even when only the 0.5 mm fractions were compared.

2. RECOMMENDATIONS

- Sampling and benthic infaunal and metals analysis should continue beyond the end of Year 3 of the Monitoring Program (Cruise M12, May, 1984), in accordance with recommendations of the Biological Task Force (November 3, 1983).

- If the Program is extended beyond Year 3, we recommend that the number of stations and/or number of cruises per year should be reduced; (e.g., concentrate sampling at the deeper Regional Stations 2, 7A, 8, 9, 13, 13A and 16 and at Site-Specific Stations 5-1, 5-18 and 5-28 at least twice per year). If additional drilling takes place in Lease Area 42 in 1984, additional stations might be established near the drill sites.

- The large volume of complex, multidisciplinary data generated should be combined and integrated into a single, comprehensive, multidisciplinary synthesis report which would go beyond the basic correlations done as part of this project.

3. INTRODUCTION

3.1 Program Objectives

The Georges Bank Monitoring Program is a multidisciplinary field monitoring program which was initiated in July, 1981 by the U.S. Department of the Interior, Bureau of Land Management (now the Minerals Management Service) in response to concerns about the potential effects of oil and gas exploratory activities in the Lease Sale 42 area on the highly productive Georges Bank environment. Specific questions addressed by this Program include the following:

1. What are the quantities, the physical characteristics, and the chemical composition of materials discharged during OCS drilling operations?

2. Where do discharged materials accumulate and in what concentrations?

3. What are the existing background levels of contaminants in the sediments and biota and what levels above background can be detected with existing technology?

4. Do benthic populations change at selected regions on Georges Bank during various stages of OCS oil and gas exploratory activity. Can these changes be related to observed changes in pollutant levels associated with discharges, and what are the concentrations of pollutants associated with these changes?

The primary objective of the Monitoring Program is to link the fate of discharges (primarily drilling fluids and cuttings) from oil and gas exploratory operations in the Lease Sale 42 area to effects on benthic species and communities. Questions dealing with the characterization and accumulation of drilling-related discharges are being addressed by the U.S. Geological Survey, which is analyzing the trace metals in bottom sediments (Bothner et al., 1982, 1983) and by Science Applications, Inc., which is performing the analysis of hydrocarbons in bottom sediments and the analysis of hydrocarbons and trace metals in benthic fauna (Payne et al., 1982, 1983). A third

component of the Program was the analysis of historical benthic infaunal samples collected in 1977 as part of the New England OCS Benchmark Study. This analysis was completed by Taxon, Inc. in March, 1983 and provides background information for comparison with the results of the ongoing benthic infaunal analyses, which constitutes the fourth component of the Monitoring Program.

This report presents the results generated by Battelle and W.H.O.I. for the first two years of monitoring of the benthic fauna at several stations on Georges Bank. Several community parameters, including density of individuals, species richness, species diversity, and similarity within and between stations over time are measured. The fluctuation over time of the population density of selected single species which comprise the community is also evaluated. These parameters are evaluated with respect to abiotic factors such as sediment grain size, total organic carbon, and levels of the hydrocarbon and trace metal components of drilling-related materials discharged during the exploratory process. Any statistically significant relationship between discharged materials and changes in the benthic infaunal parameters would constitute an "impact due to drilling activities".

3.2 Program Design

The basic design of the Monitoring Program was proposed by the Biological Task Force, a multiagency panel chartered to recommend to the U.S. Department of the Interior, Supervisor of Oil and Gas Operations in the North Atlantic, the design of environmental studies and surveys as well as periodic sampling of environmental conditions to provide warning of adverse effects of OCS oil exploration. The program recommended by the BTF was implemented by the Minerals Management Service in July, 1981, with some modifications in sampling stations and methodology. In June 1982, after the first four monitoring cruises had been conducted and initial results were available, a meeting of the Scientific Review Board was convened in Woods Hole to review the program to date. At that time, some changes in sampling stations and sampling methodology were instituted. In addition, three new components were added to the Program, including 1) a detailed analysis of the size-class structure of populations of selected species at certain stations (the Life History Task), 2) a study to determine the

linkage of benthic infaunal production to demersal fish populations (the Production and Fish Feeding Task), and 3) analysis of samples collected at USGS stations on Georges Bank prior to the commencement of drilling (Historic Infaunal Sample Task). Details of the changes in the Program between Year 1 and Year 2, and of the three new Program components, are discussed below. This report includes preliminary results of the three new Program components; the final report for Year 3 will include complete results for all three new tasks.

3.2.1 Basic Program Design

A total of 46 sampling stations were established on and adjacent to Georges Bank. These were of two types. A group of long-term regional stations (Figure 1) was established to assess long-term impacts of drilling activities over a broad expanse of the Bank. Three transects of three stations each were set up perpendicular to local isobaths, approximately in a North-South direction. The transects were located west of, east of, and directly through the Lease Sale 42 blocks, with the three stations on each transect located at approximately 60, 80, and 100 meters depth. Because net water movement over the southern flank of the Bank at all depths is toward the southwest, the eastern Transect I lies upstream, and is considered a reference transect. The western Transect III lies downstream of the drilling activity where drilling discharges could accumulate and long-term effects might occur. Additional regional stations were located at sites of possible deposition of drilling muds and cuttings from the rigs. These include stations at the heads of Lydonia and Oceanographer Canyons (Stations 7 and 9, respectively), at the shelf/slope break (Station 8), in the Gulf of Maine (Stations 14 and 14A), in the shallow part of the Bank (Station 15), and in the Mudpatch (Stations 13 and 13A), an area of fine-grained sediments south of Cape Cod.

Two groups of stations were located in close proximity to two exploratory drilling rigs in order to assess near-field impacts of drilling discharges on the benthos. Three stations (Regional Stations 16, 17, and 18) were located in the vicinity of the drilling rig in Block 410 in about 140 meters of water. Station 16 was located within 200 meters of the rig; and Stations 17 and 18 were located approximately 2,000 meters upstream and downstream, respectively of the rig site. A larger site-specific array of 29

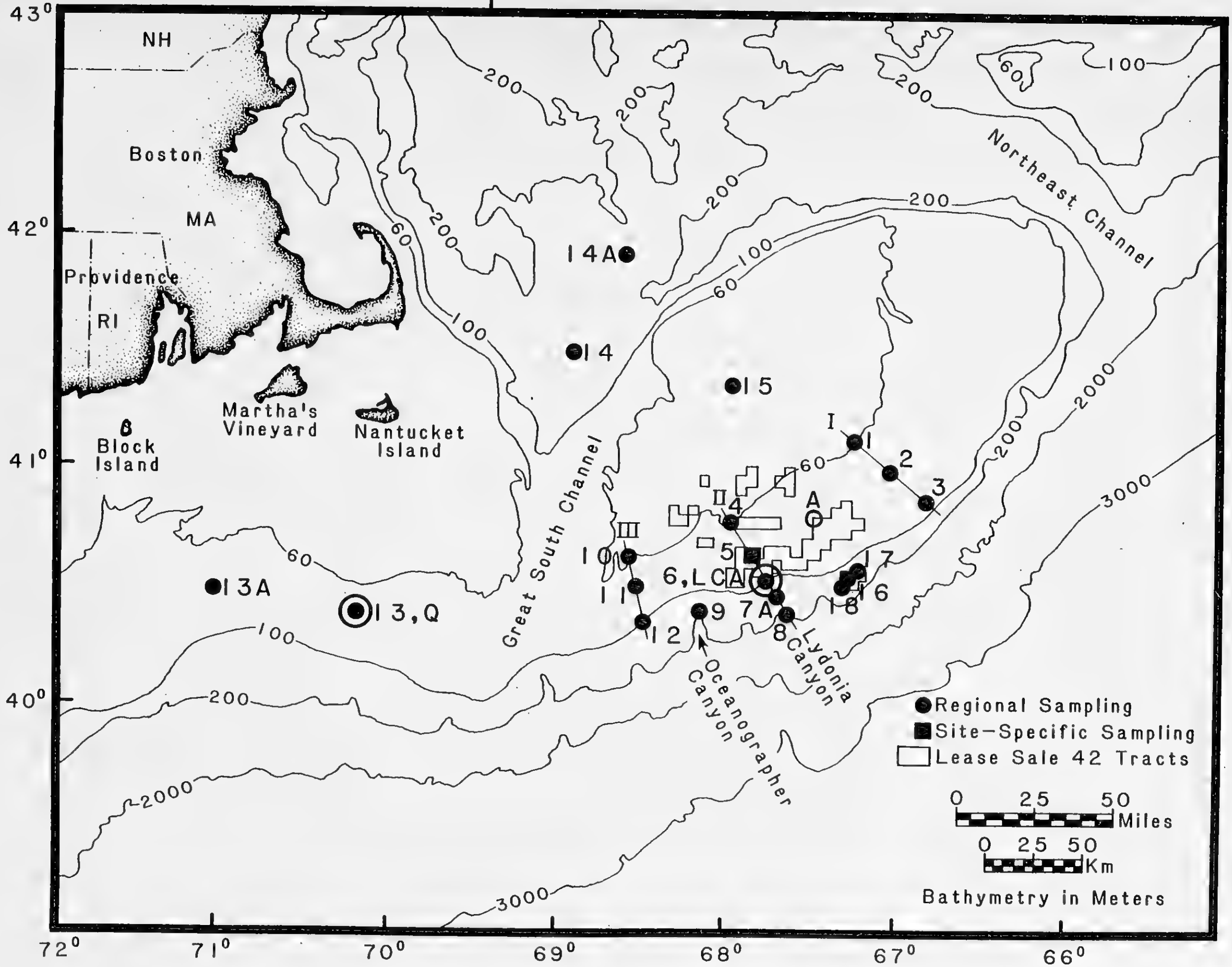


FIGURE 1. LONG-TERM REGIONAL STATIONS AND U.S.G.S STATIONS A, Q, AND LCA.

stations was located in a radial pattern around the rig in Block 312 (Figure 2). Stations were located within 200 meters and at distances of 0.5, 1, 2, 4, and 6 kilometers from the rig. An over-sampling strategy was used here. Nineteen of the stations were designated as primary stations, and all samples from these stations were analyzed. The remaining ten stations were designated as secondary stations, and samples collected from those stations were archived.

All stations are sampled four times per year on a seasonal basis. At each station, six replicate biology samples and three replicate chemistry samples of undisturbed bottom sediments are collected with Van Veen grabs. Subsamples of the biology grabs are taken for carbon-hydrogen-nitrogen (CHN) and sediment grain-size analysis, and the remainder of the sample is washed through 0.3 mm screens. Bottom photographs are taken at each station to document microtopography and epifaunal densities, and in an effort to detect possible accumulations of drilling mud and/or cuttings. Measurements of water column hydrography (salinity, temperature, dissolved oxygen) are taken at all regional stations. Dredge and trawl samples are collected at certain regional and site-specific stations to obtain fish and mollusc samples for chemical analysis and to obtain representative specimens of epifauna and demersal fish for a voucher collection to be used in identifying species observed in bottom photographs.

3.2.2 Changes in Basic Program Design After Year 1

As a result of the Scientific Review Board meeting held in Woods Hole on 24 June 1982, certain changes were made in the sampling design and were implemented on Cruise M5. These changes are listed below.

1. The large ($0.1 m^2$) Van Veen grabs which had been taken on Cruises M1 through M4 and archived were discontinued.

2. Coordinates for Regional Stations 7 and 14 were changed; the new stations were designated Stations 7A and 14A. Station 7 was repositioned to be located in the head of Lydonia Canyon, rather than on the wall of the canyon. Station 14 was relocated to be in an area of finer sediments, which would be indicative of potential depositional areas.

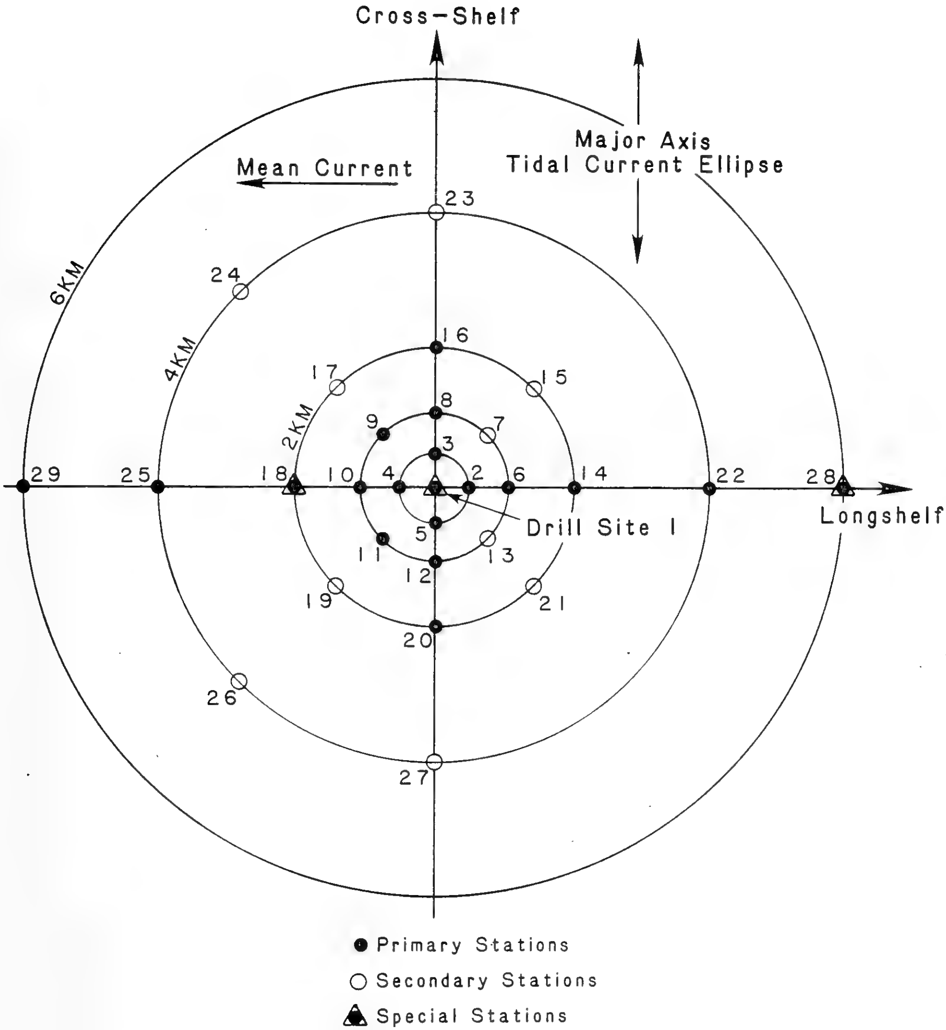


FIGURE 2. SITE-SPECIFIC STATIONS.

3. Biology grabs, CHN and sediment grain-size samples, and camera work were discontinued at Station 15. Chemistry grabs and hydrographic data were continued for Cruises M5 through M8.

4. Dredging and trawling for epifauna for chemical analysis were modified. The gear types used in Year 1 (epibenthic sled, Day dredge, Blake trawl) were not consistently successful in fishing. A Rocking Chair dredge was used in Year 2 to collect Arctica islandica at Stations 2, 5-1, 5-18, and 5-28. An otter trawl was used in Year 2 to collect demersal fish at Stations 2, 5-1, and 13.

3.2.3 Life History Task

This task was initiated in Year 2 for two purposes:

1. to refine the degree of sensitivity in detecting impacts on single species due to drilling activities, and

2. to provide additional information on species important in the diets of demersal fish, as studied in the Production and Fish Feeding Task (see below).

Use of the 0.3 mm screens in the present Monitoring Program has permitted a level of taxonomy heretofore not possible in benthic ecology. Through careful observation of a series of growth stages, it has been possible to identify the earliest juvenile stages of certain polychaete, amphipod, and echinoderm species. This capability permits the development of a very sensitive measure of settlement patterns and life history characteristics. The age-size structure and size-frequency distribution of a particular species at a station can be determined for each sampling date, and the progress of cohorts can be followed over time. It should be possible to detect any impact of drilling activities on the success of sensitive larval cohorts or individual year classes when followed over time. The species selected for study included those dominant at several monitoring stations, and also those important in the study of secondary production, discussed below.

3.2.4 Production and Fish Feeding Task

This component of the Monitoring Program was initiated in Year 2 with the major objective of linking benthic secondary production to demersal fish. Specific objectives to be addressed include:

1. estimating the production of important benthic infaunal species;
2. determining the diet of one to several demersal fish species, and estimating consumption rates;
3. comparing the rates of consumption by fish to rates of infaunal production;
4. calculating prey-selection indices by comparing stomach contents to the abundance of benthic species; and
5. correlating potential changes in benthic populations to changes in fish feeding.

The first objective is addressed by additional analysis of the benthic samples collected as a regular part of the Monitoring Program. To address the remaining objectives, collection of demersal fish species and analysis of the stomach contents was necessary. Any significant change in the biomass, production, or species composition of the benthic infauna should be reflected in the food habits of demersal fish. Information on the degree of linkage between benthic infauna and demersal fish will provide a more objective basis than heretofore available for estimating the vulnerability of benthic feeders to changes in the benthos. Results of the analysis of one such fish species, the yellowtail flounder Limanda ferruginea, are presented in this report.

3.2.5 Historic Infaunal Sample Task

This component of the Monitoring Program was added in Year 2 to analyze a selected set of benthic infaunal samples collected at three stations where the U.S. Geological Survey, with support from the Minerals Management Service, has been studying sediment transport dynamics for a number of years (under Contracts AA851-MU0-18 and

AA851-IA1-17). Station A is located between Monitoring Program Regional Stations 2 and 5; Station LCA is near Regional Station 6; and Station Q is near Regional Station 13 (Figure 1).

These samples are being analyzed to address the following objectives:

1. to evaluate both seasonal and long-term (year-to-year) variability of benthic communities at selected monitoring sites prior to commencement of exploratory drilling activities; and

2. to evaluate the importance of animal-sediment interactions in the Georges Bank Lease Sale area including, for example, the importance of benthic communities in stabilizing sediments against erosion from tidal currents or vice versa, the influence of currents and winter storms on the structure and composition of benthic communities.

Results for Station A are presented in this report; complete results for all three stations will be presented in the Final Report for Year 3.

4. METHODS

4.1 Field Sampling

Table 1 gives the coordinates of each station sampled, and Table 2 indicates the dates of each of the sampling cruises. Stations were located by LORAN-C (Northstar 6000), using average time delays obtained during Cruise M1, or, for those stations added later in the program, during the first cruise on which the station was sampled. The several types of samples collected at each regional and site-specific station on Cruises M5 through M8 are summarized in Table 3. At each station, 6 replicate 0.04 m^2 Van Veen grabs were taken for infaunal analysis. Large (0.1 m^2) grab samples were taken at all regional and primary site-specific stations for trace metal and hydrocarbon analyses.

Core subsamples for CHN and sediment grain size analyses were taken from each 0.04 m^2 grab sample immediately after collection. A plastic syringe with an inside diameter of 2.54 cm was used. No cores were removed from M1 samples; 4 cores were removed from each M2 sample, and 3 cores (1 for CHN, 2 for sediment grain size) were removed from each sample on cruises M3 through M8. Cores were frozen in labelled Whirlpak® bags immediately after collection. Removal of these cores therefore reduced the surface area analyzed for infauna by 5.07% (M2 samples) and 3.80% (M3 through M8 samples).

After the core subsamples were removed, each 0.04 m^2 sample was placed in a 9.5 liter bucket with pour spout. Filtered seawater was added to the bucket, then decanted onto a 30.5 cm diameter screen with 0.3 mm mesh. This procedure was repeated as long as a low-density organism fraction (animals with a specific gravity close to that of seawater) was obtained. The portion remaining on the screen was then transferred to a 0.45 liter jar, preserved with 10% buffered formalin in seawater and labelled both inside and outside the container. The heavy sediment residue was placed in a 3.8 liter plastic jar and similarly preserved and labelled.

Otter trawls to collect fish for hydrocarbon chemistry analysis were made at Regional Stations 1, 2, 13, 13A and between 5-14 and 5-22. A Rocking Chair Dredge was used to collect Arctica islandica for hydrocarbon analysis from Site-Specific Stations 5-3, 5-15 and 5-18, and Regional Stations 1 and 11. Specimens for chemical analysis were

TABLE 1. COORDINATES FOR GEORGES BANK MONITORING STATIONS

Long-Term Regional Station No.	Latitude	Longitude
1	41°13.0'N	67°15.3'W
2	40°59.0'N	66°55.8'W
3	40°53.7'N	66°46.5'W
4	40°50.7'N	68°00.2'W
5 (rig site)*	40°39.5'N	67°46.2'W
6	40°34.3'N	67°45.3'W
7	40°28.8'N	67°43.2'W
7A	40°32.15'N	67°44.2'W
8	40°27.1'N	67°37.4'W
9	40°26.7'N	68°09.8'W
10	40°42.0'N	68°35.3'W
11	40°30.8'N	68°33.7'W
12	40°22.2'N	68°30.2'W
13	40°29.5'N	70°12.6'W
13A	40°30.0'N	71°00.5'W
14	41°34.2'N	68°59.0'W
14A	41°57.5'N	68°31.0'W
15	41°27.5'N	68°00.7'W
16	40°34.2'N	67°12.3'W
17	40°35.0'N	67°11.7'W
18	40°33.5'N	67°13.7'W

Site-Specific Station No.	Latitude	Longitude
*5-1 (rig site)	40°39.5'N	67°46.2'W
*5-2	40°39.6'N	67°45.8'W
*5-3	40°39.8'N	67°46.1'W
*5-4	40°39.5'N	67°46.5'W
*5-5	40°39.3'N	67°46.2'W
*5-6	40°39.5'N	67°45.4'W
5-7	40°39.9'N	67°45.7'W
*5-8	40°40.1'N	67°46.1'W
*5-9	40°39.9'N	67°46.7'W
*5-10	40°39.4'N	67°46.9'W
*5-11	40°39.2'N	67°46.6'W
*5-12	40°39.0'N	67°46.1'W
5-13	40°39.2'N	67°45.6'W
*5-14	40°39.5'N	67°44.7'W
5-15	40°40.3'N	67°45.2'W
*5-16	40°40.6'N	67°46.1'W
5-17	40°40.3'N	67°47.1'W
*5-18	40°39.6'N	67°47.6'W
5-19	40°38.8'N	67°47.2'W
*5-20	40°38.5'N	67°46.1'W
5-21	40°38.8'N	67°45.1'W
*5-22	40°39.5'N	67°43.3'W
5-23	40°41.7'N	67°46.1'W
5-24	40°41.1'N	67°48.1'W
*5-25	40°39.5'N	67°49.0'W
5-26	40°38.0'N	67°48.1'W
5-27	40°37.4'N	67°46.1'W
*5-28	40°39.5'N	67°41.9'W
*5-29	40°39.5'N	67°50.4'W

*Primary Stations

TABLE 2. SCHEDULE OF SAMPLING CRUISES FOR THE GEORGES BANK BENTHIC INFAUNAL MONITORING PROGRAM

Cruise	Dates
M1	Jul 6-23, 1981
M2	Nov 9-21, 1981
M3	Feb 10-21, 27, 1982
M4	May 10-18, 1982
M5	Jul 21-28, 1982
M6	Nov 19-28, 1982
M7	Feb 5-11, 1983*
M8	May 13-21, 1983

*This cruise was shortened because of severe weather conditions. Not all samples were collected.

TABLE 3. SAMPLES COLLECTED AT GEORGES BANK MONITORING STATIONS ON CRUISES M5 THROUGH M8.

	Regional Stations	Site-Specific Stations Primary	Site-Specific Stations Secondary
$0.04m^2$ Van Veen Grab Samples	6 Replicates	6 Replicates	6 Replicates
CHN Subsamples	6 Replicates	6 Replicates	6 Replicates
Grain-Size Subsamples	6 Replicates	6 Replicates	6 Replicates
Epifaunal Samples	3 Stations Only	3 Stations Only	
Hydrographic Measurements	D.O. - 3 Salinity - 2 XBT - 1	1 Station Only: D.O. - 3 Salinity - 2 XBT - 1	
Bottom Still Photographs	20 Frames	20 Frames	
Geology and Geochemistry Grab Samples*	3 Replicates	3 Replicates	3 Replicates

*Collection coordinated.

removed, labelled, and frozen by the chemistry contractors. Only a few specimens, primarily species of fish, were returned as epifaunal voucher specimens from Cruises M5 through M8.

Bottom still photographs were taken at each regional and primary site-specific station in order to record surface topography and visible epifauna. A Benthos Model® 372 underwater camera and strobe unit were mounted on a steel frame, which was raised and lowered using a hydrowinch. The camera was triggered by a bottom switch coupled with an auto advance. A minimum of 20 color frames were exposed at each station.

Hydrographic measurements, including dissolved oxygen, salinity and water temperature profiles were made at all regional stations. A minimum of three replicates of bottom water were collected by attaching a Niskin water sampling bottle to the winch wire of the grab sampler. When the water sample was received on deck, a portion was drawn off into a Winkler (BOD) bottle, and immediately fixed with manganous sulfate and alkaline iodide solutions. A Winkler titration was performed, using an automated burette, within 3 hours of sample collection. Starting on Cruise M7, dissolved oxygen was also measured using an oxygen electrode coupled with a pH/mV meter.

Surface water samples for salinity measurements were collected using a bucket. Bottom water samples for salinity were obtained from the Niskin bottles. For Cruises M1, M2, and M5 through M8 an AUTOSAL 8400 at W.H.O.I. was used to determine conductivity. For Cruises M3 and M4, either a Hydrolab Model IIB conductivity probe or American Optical refractometer was used to take one measurement each for surface and bottom salinity.

Temperature profiles were obtained via XBT casts. A deck-mounted launcher was used to deploy the XBT, and a strip chart recorder was used to record the temperature profile with depth.

4.2 Infaunal Grab Samples

4.2.1 Laboratory Processing

All grab samples were individually logged into the Battelle laboratory when they were received upon completion of each cruise. Each sample was logged on a "Sample

Tracking Sheet" which could then be used to determine the location of any particular sample or portion thereof at any time. These sheets were initialed by each technician who handled the sample. Each sample was resieved before sorting. For Cruises M5 through M8, all regional and site-specific samples were rescreened through a nest of 0.5 mm and 0.3 mm screens (for Cruises M1 through M4, only regional stations were sieved through both screens; site-specific stations were resieved only through the 0.3 mm screen). The heavy sediment residue from each sample was elutriated with fresh water to remove low-density organisms which might not have been removed during shipboard handling. The sediment residue was then checked under low magnification to ensure that all organisms had been elutriated. The two resultant fractions of each sample (0.5 and 0.3 mm) were kept separate during sorting, identification and biomass procedures.

Each sample was stained with a solution of Rose Bengal at least four hours prior to sorting. All fractions of each sample were examined under a dissecting microscope and each organism or fragment was removed. Organisms were sorted to basic taxonomic groups such as polychaete families, Amphipoda, Isopoda, other crustacea, Mollusca, Echinodermata and "miscellaneous", which includes Porifera, Cnidaria, Bryozoa, Sipunculida, Oligochaeta, and Chordata.

A minimum of 10 percent, and an average of 20 percent, of the sample residues sorted were subjected to a quality control check before the vials containing organisms were released for final identifications. In this check, the sample residues were partly or completely reexamined by the sorting laboratory supervisor or by a technician other than the one who originally sorted the sample. At least 10% of the samples sorted by any one technician were completely resieved and resorted. When each sample was finished, the low density or light fraction was stored in 70% alcohol in a zip-loc bag which was then placed inside the 1 gallon jar containing the heavy sediment residue, also in 70% alcohol. All sample residues from M5 through M8 are archived at Battelle. Residues from samples analyzed from M1 through M4 have been discarded.

Identifications were made to the lowest possible taxon, usually to species. For most major taxonomic groups (i.e. Arthropoda, Mollusca, Echinodermata), a single identifier was responsible for the entire sample. However, the Polychaeta, which represents the single most complex and difficult group of organisms present in the samples, were identified by a series of individuals each experienced with a particular

group of families. In only a very few cases, for example with juvenile polychaetes, have we been unable to distinguish separate species and have been forced to use a category which might include 2 or more species. In some cases, these problem identifications have been worked out during the course of this program. Voucher specimens of molluscs, arthropods and oligochaetes were submitted for verification to Dr. Robert C. Bullock, University of Rhode Island, Dr. Les Watling, University of Maine, and Dr. Christer Erséus, University of Göteborg, Sweden, respectively. Taxonomic problems were also discussed with Dr. John Dearborn, University of Maine (echinoderms) and Dr. Kristian Fauchald, Smithsonian Institution (polychaetes).

Counts of individuals were recorded separately for the 0.5 and 0.3 mm screen. Notations were also made as to visible reproductive condition and presence of juveniles where appropriate.

Wet weight biomass was determined separately for each species. Weights were recorded to the nearest 0.001 gram after blotting for 30 seconds. Hard parts of organisms were not removed prior to weighing. Therefore, the shells of molluscs and calcareous endoskeletons of echinoderms were included in the weights.

4.2.2 Data Reduction and Analysis

Completed data sheets for data from Cruises M5 through M8 were coded at Battelle and entered into the VAX 11/780 computer at Woods Hole Oceanographic Institution. Verification of hard copy printout and correction of any errors was conducted jointly by Battelle and W.H.O.I. Some errors extant in the data set generated for Cruises M1 through M4 were corrected during this process. Such errors included the misidentification of a few specimens, and also erroneous numbers mistakenly keypunched and not corrected during data verification last year.

Statistical treatment of the infaunal data set included an agglomerative clustering technique (Williams, 1971) to determine similarity between samples. The first step in this classification is to measure similarity between all pairwise combinations of samples, starting with the most similar pairs, and subsequently combining samples until they all combine into one large group. The similarity measure used is NESS, the Normalized Expected Species Shared (Grassle and Smith, 1976), where the comparison of

expected species shared is between random samples of 50 individuals from the initial collection of individuals in each grab. Since two samples of 50 drawn from within each of the samples are required for normalization, samples with less than 100 individuals are excluded from the analysis. The method has also been used with m (i.e. sample size) set at 200 individuals. NESS is more sensitive to the less common species than other commonly used methods. The clustering strategy is flexible sorting with β set at the commonly used value of -0.25 (Boesch, 1977; Williams, 1971). Flexible sorting allows more intense clustering than the other commonly used methods, such as the group average or unweighted pair-group method. Boesch (1977) points out that intense clustering strategies are often prone to misclassifications and "one often has to choose between non-classifications due to weakly clustering strategies or misclassifications due to intensely clustering strategies". This is not the case with NESS. We have also used the Bray-Curtis or percent similarity coefficient (Boesch, 1977) as a similarity measure with group average sorting. This multivariate analysis procedure was performed on raw data, on log transformed data, and also on a fourth root transformation of the data set. The few individuals where the species identification is uncertain (juveniles, fragments, etc.) are not used in the analysis. The animals attached to hard surfaces such as rocks and shells, parasitic and planktonic species are also excluded from the analyses.

Shannon-Wiener diversity (H') was calculated:

$$H'_{(s)} = - \sum_{j} p_j \log p_j$$

in which s is the total number of species, and p_j is the observed proportion of individuals belonging to the j^{th} species (j = 1,2,....,s).

Hurlbert's modification (1971) of the rarefaction method (Sanders, 1968) was used to predict the number of species in a random sample without replacement, given a population N:

$$E\left[S_m/N\right] = \sum_{i=1}^{k} 1 - \frac{(N_m - N_i)}{\binom{N}{m}}$$

in which N_i is the finite population of species i; N is $(N_i, N_2, \ldots, N_k)$, a vector representing the entire finite population; and N is the total number of individuals in the finite population,

$$\sum_{i=1}^{k} N_i;$$

and S_m is the random variable denoting the number of species in a sample of size m (Smith and Grassle, 1977). For the species diversity results presented, we have used m=50 or the number of species per 50 individuals, m=100 or the number of species per 100 individuals, m=500, and m=1,000.

Spearman rank correlation (Siegel, 1956) was used to test the association between biological variables such as density of individual species or community similarity indices and physical variables such as sediment grain size.

4.3 Epifaunal Samples

Voucher specimens from dredge and trawl collections were identified to species and stored in separately labelled glass jars or buckets. No voucher specimens were retained from Cruises M7 and M8, since no species new to the collections were retrieved.

4.4 Bottom Still Photographs

Film from Cruises M5 through M8 was developed at W.H.O.I. after each cruise was completed. Each frame was projected onto a screen and examined for characteristics of surface topography. Visible epifauna were identified and counted, and biogenic features of sediments were noted. Assuming that the trigger switch wire was 1.83 m long, the area of bottom covered by each frame is slightly greater than 1 square meter.

4.5 Life History Analysis

4.5.1 Size Frequency Analyses

4.5.1.1 Laboratory Methods. Species selected for length-frequency analysis included both polychaetes and amphipods. The three amphipod species chosen included Unciola inermis, Ericthonius rubricornis and Ampelisca agassizi. Populations of these species at Stations 5-1 and 13 were chosen for initial analysis because fish stomachs were also collected at these locations (see Section 4.5.2 below). Seventeen species of polychaetes were examined, primarily from Stations 5-1 and 13. Populations of Tharyx acutus, T. annulosus, T. dorsobranchialis, Aricidea catherinae, A. suecica, Levinsenia gracilis, and Cossura longocirrata were examined at Station 13. Species studied from Station 5-1 included Tharyx acutus, Tharyx sp. A, Exogone hebes, E. verugera, Sphaerosyllis cf. brevifrons, Parapionosyllis longicirrata, Streptosyllis arenae, and Syllides benedicti. In some cases, individuals collected at the nearby Stations 5-2, 5-3, and 5-4 were combined with those from Station 5-1 to make up an adequate sample size. Finally, from the Block 410 Stations 16 and 18, Aricidea neosuecica, Paradoneis sp. A and Paraonis sp. A were chosen for analysis.

In this first year of this task, populations from Cruises M1 through M4 were studied. In the next year of the task, populations from the subsequent cruises (M5 through M12) will be analyzed. An additional species, the sand dollar Echinarachnius parma, will also be studied during the next year.

The amphipod species were measured at W.H.O.I., using a Radio Shack digitizer coupled to a Radio Shack TRS-80 Model II microcomputer. A calibration factor built into the software allowed immediate conversion of the distance covered by the digitizer into length in millimeters. The parameter measured for each species was the length from the tip of the rostrum to the base of the telson (Bousfield, 1973) as traced with the digitizer on a camera lucida projection of the specimen. Sample size permitting, a minimum of 200 animals were measured for each species and each cruise.

For polychaete species, number of setigers rather than measured length is the parameter of choice for determining size class frequencies. Length measurements cannot always be substituted directly for setiger number, because of differential contraction of

individuals during fixation. However, specimens are often fragmented or coiled, precluding complete and accurate setiger counts as well as measurements. Therefore, in addition to counting setigers when possible, a series of measurements of additional morphological characters were made for each species studied. Such measurements included: thorax width, prostomial length, proventricle length (in syllids), and number of branchiae. A sample size of 100 was used where possible; however, this was not obtained for certain species on certain cruises.

Observations were made on specimens mounted in glycerine on glass slides. Initial measurements were made on a Wild dissecting microscope; smaller details were measured on an Olympus BH-2 compound microscope with an ocular micrometer.

For Cruise M1, setigers were counted for each whole specimen. Only entire individuals were measured for abundant species; for less abundant species, measurements were made on all specimens, including those which were fragmented.

4.5.1.2 Statistical Analyses. All data on polychaete species were coded and entered into the Woods Hole Oceanographic Institution's VAX/11-780 computer and subprogram NEW REGRESSION of SPSS (Statistical Package for the Social Sciences; Hull and Nie, 1981) was used to fit the "best" regression equation relating setiger count to the measured variables. In addition to the original linear scale variables, the natural $\log_e(X)$, square (X^2), and cube (X^3) of each variable were calculated and also entered into the analysis. The resulting regression equations and their associated coefficients of determination (r^2) are shown in Table 4.

The regression equations were used to calculate number of setigers for those specimens of the 12 species for which direct counts of setigers were lacking for Cruises M2 through M4. For specimens which were used to fit the regressions (i.e. those for which setigers were counted), the actual counts are presented rather than calculated values. For the remaining five species (Cossura longocirrata, Aricidea neosuecica, Paradoneis sp. A, Paraonis n. sp. A, Tharyx sp. A), regression analysis did not suggest a good alternate measurement. Sufficient specimens were available for which counts of setigers could be obtained directly.

Subprogram FREQUENCIES of the SPSS package (Nie, et al., 1975) was used to generate frequency distributions for each species by cruise at five-setiger intervals.

TABLE 4. FITTED REGRESSION EQUATIONS USED TO EVALUATE NUMBER OF SETIGERS FOR LIFE HISTORY ANALYSIS.

Species	Regression	r^2
Tharyx acutus	SETIGERS = 107.8 + 38.2 $\log_e$ (thorax width)	0.75
Tharyx annulosus	SETIGERS = 101.2 + 32.8 $\log_e$ (thorax width)	0.64
Tharyx dorsobranchialis	SETIGERS = 10.8 + 252.1 (thorax width)	0.46
Aricidea catherinae	SETIGERS = 14.3 + 0.2 (number of gills^2) + 150.9 (thorax width^2)	0.75
Aricidea suecica	SETIGERS = 121.8 + 43.9 $\log_e$ (thorax width)	0.64
Levinsenia gracilis	SETIGERS = 19.3 + 7.7 (number of gills) - 0.038 (thorax width^3)	0.64
Exogone hebes	SETIGERS = 82.9 (length of proventricle) + 2.3	0.78
Exogone verugera	SETIGERS = 128.2 (length of proventricle) - 6.8	0.87
Sphaerosyllis cf. *brevifrons*	SETIGERS = 121.3 (length of proventricle) - 2.0	0.91
Parapionosyllis longicirrata	SETIGERS = 10.3 (total length) + 9.2	0.83
Streptosyllis arenae	SETIGERS = 8.2 (total length) + 13.2	0.92
Syllides benedicti	SETIGERS = 9.0 (length of proventricle) + 10.9	0.83

4.5.2 Reproductive Characteristics

In addition to determining the size class frequency of the polychaete species populations, all specimens were examined under the compound microscope for evidence of reproductive characteristics. The presence of eggs (or oocytes), their size and location in or on the body, the presence, location and arrangement of sperm or spermatophores, the presence and degree of development of brooded young, and the presence of any obvious or unusual reproductive structures were recorded. In order to enhance the ability to interpret the nature of reproductive structures or products, whole mount and thin section preparations were necessary. Specimens stained in haematoxylin were mounted in glycerine from 70% isopropanol. Unstained specimens were cleared and mounted in Euparal (GBI Laboratories, Inc., Denton, U.K.) directly from 99% isopropanol. Thin sections of several particularly unusual specimens were made. The specimens were embedded in formalin-agar (Boldorac, 1979), cut at 5 μm, and stained with hematoxylin and eosin, using standard histological procedures.

4.6 Production and Fish Feeding

4.6.1 Fish Stomach Content Analysis

Stomachs of the yellowtail flounder, Limanda ferruginea, were collected by the National Marine Fisheries Service (Northeast Fisheries Center) on a quarterly basis from Summer 1982 to Spring 1983. Stomach collection coincided as closely as possible to the dates and locations of benthic monitoring cruises M5 through M8. Monitoring Stations 5, 10 and 13 were chosen for fish stomach analysis because the macrofaunal assemblages differ significantly between these stations.

The stomachs were transferred to Battelle for content analysis. Each stomach was cut longitudinally and the entire bolus removed, described in terms of the state of digestion, and wet-weighed to the nearest 0.001 g after blotting. Stomach contents were sorted to species and enumerated. Partially digested polychaete fragments were counted if the head was present and an identification could be made. The same protocol was followed for amphipods, except for species of Unciola. The taxonomic characters needed

for species identification in this genus include the third epimeral plate and 5th coxa. Specimens lacking these characters could not be speciated and were recorded as Unciola spp. The wet weight biomass of each taxon was estimated to the nearest 0.001 g.

Arthropod species were then transferred to W.H.O.I. for length frequency measurements. Polychaete species were retained at Battelle for similar measurements.

4.6.2 Prey Preference Analysis

All data were coded and entered into the VAX 11/780 computer at W.H.O.I. Hard copy printout was verified and any errors corrected.

Ivlev's (1961) electivity index was used to compare the species composition of the stomach contents to that of the macrofauna. Electivity, E, by a given predator species for a given prey species is calculated as

$$E = r-p/r+p$$

where r and p are the identifiable proportions of the prey species in the fish species diet and in the benthos, respectively. E varies from 1 to -1 with 0 indicating neutral selection. In this application, species proportions are calculated on the basis of numbers rather than weights because the numbers are more reliable. For each date and station, species numbers were summed over all stomachs and all 6 replicates for the benthos before taking proportions. Seventeen percent of prey items in the genus *Unciola* could not be identified to species. These individuals were assigned to *U. inermis* and *U. irrorata* according to the relative identifiable proportions of these two species in the diet at that station and date.

4.7 Historic Infaunal Sample Task

Samples for analysis of benthic community structure at Station A were collected using an 0.04 m^2 Van Veen grab. Three to five replicates were collected on each of seven sampling dates: May and December, 1980; January, April, and September, 1981; and January and July, 1982. A total of thirty-two samples were collected; ten were previously analyzed, and 22 were analyzed as part of the present task. All samples were

sieved aboard ship through a screen with 0.3 mm mesh, and preserved in 10 percent buffered formalin. Sorting of the organisms from the sediment residue was done at Battelle according to the methods discussed above (Section 4.2.1). Identification and enumeration of organisms and data analysis was done at W.H.O.I., also following methods used for monitoring program samples and data (Sections 4.2.1 and 4.2.2).

4.8 CHN Analysis

Frozen sediment samples for CHN analysis were thawed at room temperature, homogenized, and approximately 5 g from each replicate set aside for analysis. The remaining portion of each replicate was refrozen and archived at Battelle. Because of a concern over the inappropriate retention of carbonates in the samples analyzed from Cruises M1 through M4, the method of preparation of samples for CHN analysis was modified to include an acid treatment (see below). Because of this change in methodology, Year 1 data (inorganic carbon included) and Year 2 data (inorganic carbon removed) are not directly comparable. Some Year 1 samples were reanalyzed by U.S.G.S. in Reston, Virginia to determine the percent inorganic carbon; this analysis showed that although the percent contribution of inorganic carbon was very low, it was not consistent between stations.

Each sample was dried at 70°C for 24 hours and subsequently ground by mortar and pestal to a fine homogeneous powder. All glassware used was fired at 550°C for 24 h to remove traces of organic carbon. Carbonates were eliminated with the addition of 5 ml of 6% sulfurous acid (Gibbs, 1977). Due to the relatively low $CaCO_3$ content of most Georges Bank samples, effervescence caused by the evolution of CO_2 was minimal and the visual end point of the reaction (i.e., discontinued effervescence) could not always be observed. Optimal acid exposure time for complete dissolution of carbonates and retention of organic carbon was determined by exposing 10 replicate samples to the acid for periods ranging from 0 - 36 hours. The results of this test (Table 5) indicated no relationship between measured percent carbon and length of acid treatment. Therefore, if effervescence was not observed, the sample was exposed to acid for a minimal period of time.

TABLE 5. RESULTS OF EXPOSING TEN REPLICATE SEDIMENT SAMPLES FOR DIFFERENT LENGTHS OF TIME TO ACID TREATMENT.

Replicate Number	Time (Hrs) Exposed to Acid Treatment	%C	%H	%N
1	0*	0.05	0.01	0.00
2	4	0.03	0.01	0.00
3	8	0.05	0.01	0.00
4	12	0.04	0.01	0.00
5	16	0.02	0.01	0.00
6	20	0.05	0.02	0.00
7	24	0.04	0.01	0.00
8	28	0.05	0.01	0.00
9	32	0.04	0.01	0.00
10	36	0.05	0.02	0.00

*Indicates that the sample was swirled briefly in acid and immediately washed.

Following acid treatment, each sample was washed to eliminate acid salts using a Millipore® apparatus fitted with a glass fiber filter. Organic carbon-free water used in the washing process was prepared by filtering tap water through a particle filter, seven in-line deionizing and water softening filters, and into a Milli-Q Reagent Grade water system. This system consisted of a Super-C carbon filter, two ion exchange cartridges, and an Organex-Q filter, which produced water with a resistivity of 18 megohm-cm.

Washed samples were redried at 70°C for 24 h, and sent to W.H.O.I. for analysis. A Perkin-Elmer Model 240 Elemental Analyzer, which determines the carbon, hydrogen and nitrogen content of organic compounds by analyzing their combustion products, CO_2, H_2O and N, was used. Combustion occurs in pure oxygen under static conditions at 1,000°C. Helium is used as the carrier gas. Combustion products are then analyzed automatically in a self-integrating, steady state, thermal conductivity analyzer. An on-line computer provides immediate conversion of the digital display into percentages of carbon, hydrogen, and nitrogen present in the sample.

Analytical precision and accuracy were verified by several methods. Replicate carbon-containing reference samples prepared by the National Bureau of Standards were sent by Battelle for analysis at W.H.O.I. Fifteen Georges Bank samples previously analyzed at W.H.O.I. were re-analyzed by U.S.G.S. in Reston, Virginia. In addition, test blanks and replicates of labelled samples were analyzed daily at W.H.O.I. and test standards were routinely run to assert that analyses were quantitative.

4.9 Sediment Grain Size Analysis

All samples for sediment grain size analysis were frozen upon collection and thawed just prior to analysis. The procedures followed are identical to those used by the U.S.G.S. for their analyses of Georges Bank sediment samples. A coarse sieving technique is used to separate gravel, sand, and silt-clay fractions, and the percentage each of silt and clay is determined using pipette analysis. The Rapid Sediment Analyzer (Gibbs, 1974) is used for further analysis of the sand fractions. All analyses were performed at W.H.O.I.

5. RESULTS

5.1 Taxonomic Composition and Station Characterization

5.1.1 Taxonomy

The species found in all infaunal samples analyzed from Cruises M1 through M8 are listed in Appendix A, and those species retained from epifaunal samples are recorded in Appendix B. The annotated species list (Appendix C) contains comments or descriptions of species designated as new-to-science or those which are rare in the samples or otherwise interesting.

Excluding categories labelled "sp. juvenile" or "spp.", which might represent two or more taxa which cannot be separated because of the lack of development of diagnostic characters, a total of 926 taxa have been identified to date. Some identifications have been refined, resulting in the deletion of a few species from the list given in the Final Report for Year 1 (Appendix A, Battelle and W.H.O.I., 1983), but the total given above represents a net addition to the list of 143 taxa. Over 75 of the species listed, including the poriferans, hydrozoans and ectoprocts, are entirely epifaunal, and a few species such as the bivalve Dacrydium vitreum and the two hyperiid amphipods Hyperia galba and Parathemisto gaudichaudii, are epizootic. Several molluscs are found only on hard substrates such as rocks; these include species of Crepidula and Anomia. The five species of fish listed are also clearly not usual members of the infauna. Such types of species are excluded from the statistical analysis of the infaunal samples.

Polychaetes were represented by 378 species, and accounted for 40.8 percent of all taxa identified, a proportion similar to the 39.1 percent reported for samples from M1 through M4 only. The actual number of species reported represents an increase of 71 species over last year, and in fact, 11 species were deleted from the list due to refinements in the identifications, while 82 species were added. The relocation of Stations 7 and 14, the addition of Station 13A, and the collection of a few rare species at existing stations contributed to the increased number of polychaete species reported. Two families, Euphrosinidae and Pilargidae, with one and two species, respectively, were newly recorded. Eleven taxa were newly recorded for the families Maldanidae and

Terebellidae, with fewer new taxa reported for an additional 24 families. Of the 48 families recorded, the spionids, paraonids, syllids and maldanids continued to be the best represented, with 32, 31, 30 and 30 species, respectively. These four families therefore accounted for 32.5 percent of all polychaete species recorded. The next most abundant families were terebellids (20 species), phyllodocids (19 species), ampharetids (18 species), cirratulids (16 species) and sabellids (15 species). The remaining families were represented by ten or fewer species.

The oligochaete species list has been revised based on the advice of Dr. Christer Erséus of the University of Goteborg in Sweden, who has examined voucher collections and additional material during this past year. According to Dr. Erséus, our material includes an undescribed taxon that represents a new family of Oligochaeta.

Arthropods were represented by 182 species, an increase of 23 taxa over the number reported for samples from M1 through M4. Arthropods thus account for 19.6 percent of all taxa identified. Amphipods continue to be the dominant group, with 96 species, or just over half of all arthropod species recorded.

Molluscs were represented by 148 species, an increase of 16 taxa over the number reported last year. Molluscs therefore accounted for 16 percent of all taxa identified.

5.1.2 Dominant Species

The ten dominant species at each regional station, for samples summed over all eight sampling cruises, are presented in Table 6. In that table, stations are grouped according to their similarity as defined by NESS (see below). The ten dominant species at each station are listed separately for each cruise in Appendix H.

Stations 1, 4, and 10 at the 60 m isobath continue to be similar to each other in terms of dominant species. With the inclusion of data from M5 through M8, the order of dominance of some species changed within the list of the top ten, but essentially the same species comprise the list for all eight cruises as for the first four. Inspection of the individual lists for each cruise reveals that occasionally a species which does not appear in the consolidated list of dominants will be a dominant on a single sampling occasion. For example, *Spiophanes bombyx* is listed as the tenth most numerous species at Station 1 in

TABLE 6. DOMINANT SPECIES AT REGIONAL STATIONS SUMMED OVER ALL EIGHT SAMPLING SEASONS. STATIONS ARE GROUPED ACCORDING TO MAJOR CLUSTERS AS DELIMITED BY NESS SIMILARITY.

	Station 1	Station 4	Station 10
1.	Tanaissus lilljeborgi	Polygordius sp. A	Polygordius sp. A
2.	Polygordius sp. A	Protohaustorius wigleyi	Echinarachnius parma
3.	Echinarachnius parma	Tellina agilis	Tannaissus lilljeborgi
4.	Pseundunciola obliquua	Rhepoxynius hudsoni	Rhepoxynius hudsoni
5.	Tellina agilis	Echinarachnius parma	Protohaustorius wigleyi
6.	Protohaustorius wigleyi	Pseudohaustorius carolinensis	Exogone hebes
7.	Bathyporeia quoddyensis	Erichthonius rubricornis	Tellina agilis
8.	Rhepoxynius hudsoni	Procerea cornuta	Paraonis n. sp. A
9.	Capitella spp.	Nemertean sp. A	Nemertean sp. A
10.	Spisula solidissima	Spisula solidissima	Streptosyllis varians

	Station 2	Station 5	Station 11
1.	Parapionosyllis longicirrata	Erichthonius rubricornis	Polygordius sp. A
2.	Byblis serrata	Sphaerosyllis cf. brevifrons	Aglaophamus circinata
3.	Sphaerosyllis cf. brevifrons	Exogone hebes	Tubificoides n. sp. A
4.	Exogone hebes	Exogone verugera	Erichthonius rubricornis
5.	Exogone verugera	Unciola inermis	Nucula proxima
6.	Peosidrilus biprostatus	Parapionosyllis longicirrata	Protodorvillea gaspeensis
7.	Echinarachnius parma	Peosidrilus biprostatus	Levinsenia gracilis
8.	Streptosyllis arenae	Euclymene sp. A	Echinarachnius parma
9.	Polygordius sp. A	Aricidea (Acmira) catherinae	Arctica islandica
10.	Syllides benedicti	Tharyx acutus	Nucula delphinodonta

	Station 3	Station 6	Station 12
1.	Erichthonius rubricornis	Ampelisca agassizi	Ampelisca agassizi
2.	Notomastus latericeus	Erichthonius rubricornis	Polygordius sp. A
3.	Polygordius sp. A	Exogone hebes	Ophelina cylindricaudata
4.	Protodorvillea gaspeensis	Polygordius sp. A	Protodorvillea gaspeensis
5.	Ampelisca agassizi	Protodorvillea gaspeensis	Exogone hebes
6.	Aglaophamus circinata	Notomastus latericeus	Notomastus latericeus
7.	Paraonis n. sp. A	Aglaophanus circinata	Unciola irrorata
8.	Unciola inermis	Paraonis n. sp. A	Paraonis n. sp. A
9.	Exogone hebes	Euchone hancocki	Aricidea (Acmira) catherinae
10.	Arctica islandica	Tubificoides n. sp. A	Aricidea (Allia) suecica

TABLE 6. (Continued)

Station 7*

1. Lumbrineris latreilli
2. Phallodrilus tenuissimus
3. Eclysippe sp. A
4. Protodorvillea gaspeensis
5. Chone duneri
6. Polygordius sp. A
7. Aricidea (Acmira) neosuecica
8. Tharyx marioni
9. Aricidea (Acmira) catherinae
10. Tharyx acutus

Station 8

1. Ampelisca agassizi
2. Lumbrineris latreilli
3. Aricidea (Acmira) catherinae
4. Tharyx marioni
5. Aricidea (Acmira) neosuecica
6. Chone duneri
7. Paraonis n. sp. A
8. Nierstrassia fragile
9. Tharyx sp. A
10. Polycirrus sp. A

Station 9

1. Ampelisca agassizi
2. Protodorvillea gaspeensis
3. Aricidea (Acmira) catherinae
4. Eclysippe sp. A
5. Polygordius sp. A
6. Paraonis n. sp. A
7. Tubificoides n. sp. A
8. Lumbrineris latreilli
9. Tharyx marioni
10. Tharyx annulosus

Station 13

1. Cossura longocirrata
2. Levinsenia gracilis
3. Tubificoides n. sp. A
4. Euchone incolor
5. Ampelisca agassizi
6. Ninoe nigripes
7. Aricidea (Acmira) catherinae
8. Mediomastus fragilis
9. Lumbrineris impatiens
10. Aricidea (Allia) suecica

Staton 13A**

1. Ampelisca agassizi
2. Aricidea (Allia) suecica
3. Cossura longocirrata
4. Tharyx annulosus
5. Exogone verugera
6. Tubificoides sp. A
7. Myriochele sp. A
8. Protodorvillea gaspeensis
9. Terebellides stroemi
10. Tharyx acutus

Station 7A**

1. Ampelisca agassizi
2. Cossura longocirrata
3. Levinsenia gracilis
4. Aricidia (Allia) suecica
5. Lucinoma filosa
6. Periploma papyratium
7. Aricidea (Allia) quadrilobata
8. Thyasira sp. B
9. Terebellides stroemi
10. Harpinia propinqua

Station 16

1. Paradoneis n. sp. A
2. Chone duneri
3. Notomastus latericeus
4. Peosidrilus biprostatus
5. Enteropneusta sp. E
6. Tharyx marioni
7. Polycirrus sp. A
8. Ampelisca agassizi
9. Tharyx annulosus
10. Schistomeringos caeca

Station 17

1. Paradoneis n. sp. A
2. Notomastus latericeus
3. Chone duneri
4. Tharyx marioni
5. Peosidrilus biprostatus
6. Polycirrus sp. F
7. Aricidea (Acmira) neosuecica
8. Nierstrassia fragile
9. Enteropneusta sp. E
10. Polycirrus sp. A

Station 18

1. Ampelisca agassizi
2. Chaetozone n. sp. B
3. Tharyx annulosus
4. Thyasira sp. B
5. Notomastus latericeus
6. Lumbrineris latreilli
7. Aricidea (Acmira) catherinae
8. Aricidea (Acmira) neosuecica
9. Paraonis n. sp. A
10. Nierstrassia fragile

Station 14A**

1. Tharyx annulosus
2. Euchone incolor
3. Protodorvillea gaspeensis
4. Nuculana messanensis
5. Terebellides stroemi
6. Paradoneis lyra
7. Cossura longocirrata
8. Ophiura robusta
9. Lumbrineris sp. C
10. Barantolla sp. A

Station 15*

1. Exogone hebes
2. Spisula solidissima
3. Polygordius sp. A
4. Echinarachnius parma
5. Peosidrilus biprostatus
6. Tanaissus lilljeborgi
7. Grania n. sp. A
8. Streptosyllis websteri
9. Parapionosyllis longicirrata
10. Nemertean sp. B

*Data from Stations 7 and 15 include M1 through M4 only.
**Data from Stations 7A, 13A, and 14A include M5 through M8 only.

samples from M5, and the seventh most numerous in M8 samples (Table H-1). Similarly, Nephtys bucera is listed as a dominant at Station 1 for M3 and M8, and Aglaophamus circinata for M8 at Station 4 and M7 and M8 at Station 10 (Tables H-4 and H-11). None of these species appear on the consolidated list of dominants (Table 6).

Stations 2 and 5, at 80 m depth, continue to be dominated by syllid polychaetes. The dominant oligochaete species reported for these stations in Year 1, Phallodrilus coeloprostratus, has been reidentified as Peosidrilus biprostatus (Erséus, personal communication). Similarly, the syllid polychaete Sphaerosyllis sp. A is now referred to as S. cf. brevifrons. Byblis serrata continued to be the dominant amphipod at Station 2, except in M5 samples, when Erichthonius rubricornis, the tenth most numerous species, was the only amphipod among the dominants (Table H-2). E. rubricornis remained the dominant amphipod at Station 5-1 in Year 2 as in Year 1. Other dominant species at Station 5-1 were basically similar between cruises, although some shifts in ranking did occur (Table H-5).

At Station 3, at 100 m depth, the amphipod Erichthonius rubricornis was the top dominant in M5, M6, M7, and M8, thereby accounting for the movement of that species from eighth place in Year 1 to first place for M1 through M8. Ampelisca agassizi continued to be a dominant species at Station 3, although it ranked only fifth at this station, and first at Stations 6 and 12, also at the 100 m depth contour.

Stations 13A and 7A were added during Year 2 of the Monitoring Program. Both have very fine sediments, and share several dominant species, including Ampelisca agassizi, Cossura longocirrata, and Aricidea suecica. These two stations are similar to Station 13, where C. longocirrata is also dominant. The oligochaete species, Limnodriloides medioporus, listed in Year 1 as a dominant at Station 13, has been reidentified as Tubificoides n. sp. A (Erseus, personal communication).

At the Block 410 Stations 16, 17, and 18, Ampelisca agassizi was the top dominant at Station 18 on all eight sampling occasions (Table H-20). At Stations 16 and 17, although Paradoneis n. sp. A remained the top dominant, another polychaete species, Chone duneri, which was a dominant only once in M1 through M4, ranked either first (Station 16 - M5 and M6), second (Station 16 - M7, M8; Station 17 - M5 and M6), or third (Station 17 - M7 and M8) in Year 2.

5.1.3 Density

The average number of individuals per 0.04 m^2 (i.e. one grab sample), plus or minus one standard deviation, is graphed for all regional stations for each of the eight sampling periods in Figures 3-6. At many stations, average densities were higher for M5 through M8 than for M1 through M4. This was clear at such stations as Stations 2 and 4 (Figure 3), Station 5-1 (Figure 4), and Stations 13, 16, and 17 (Figure 6). At other stations, such as Stations 1, 8, and 9 (Figures 3-5) densities remained rather constant over all eight sampling periods.

At Station 13, the pattern of increasing density over the first three sampling seasons, followed by a sharp decline in the fourth, was not repeated in Year 2. Although there was a clear recovery, with almost a four-fold increase in the average number of individuals from M4 to M5, this was followed by a gradual decline in the average density (Figure 6). This general pattern was repeated by several individual species, discussed below. This apparently significant difference for the M4 samples does not appear to be a sampling artifact, since several large-bodied, deep-dwelling species such as *Cossura longocirrata* exhibited this pattern, as well as surface dwelling amphipod species. Data not presented here for Station 13A for M4 indicate that a similar pattern of low densities were seen at that station also. This was followed by increases to an average of 800-1200 individuals per 0.04 m^2 in M5, M6, and M8. The explanation for the low M4 densities is not clear, but may represent a long-term trend with a greater than annual cycle.

Figures 7-11 present similar average density information for the site-specific station array around Station 5-1. Only three site-specific stations, Stations 5-1, 5-18, and 5-28, were sampled on Cruise M7, when severe weather conditions forced an early return from the field. At many stations, including the rig site Station 5-1 and surrounding stations, average densities were generally higher in Year 2 than in Year 1 (Figure 7). The average density at the downcurrent Station 5-29 was generally half of that recorded for Station 5-1.

5.1.4 Diversity

Community parameters for regional stations, including total number of individuals and species, Shannon-Wiener diversity (H') and its associated evenness value

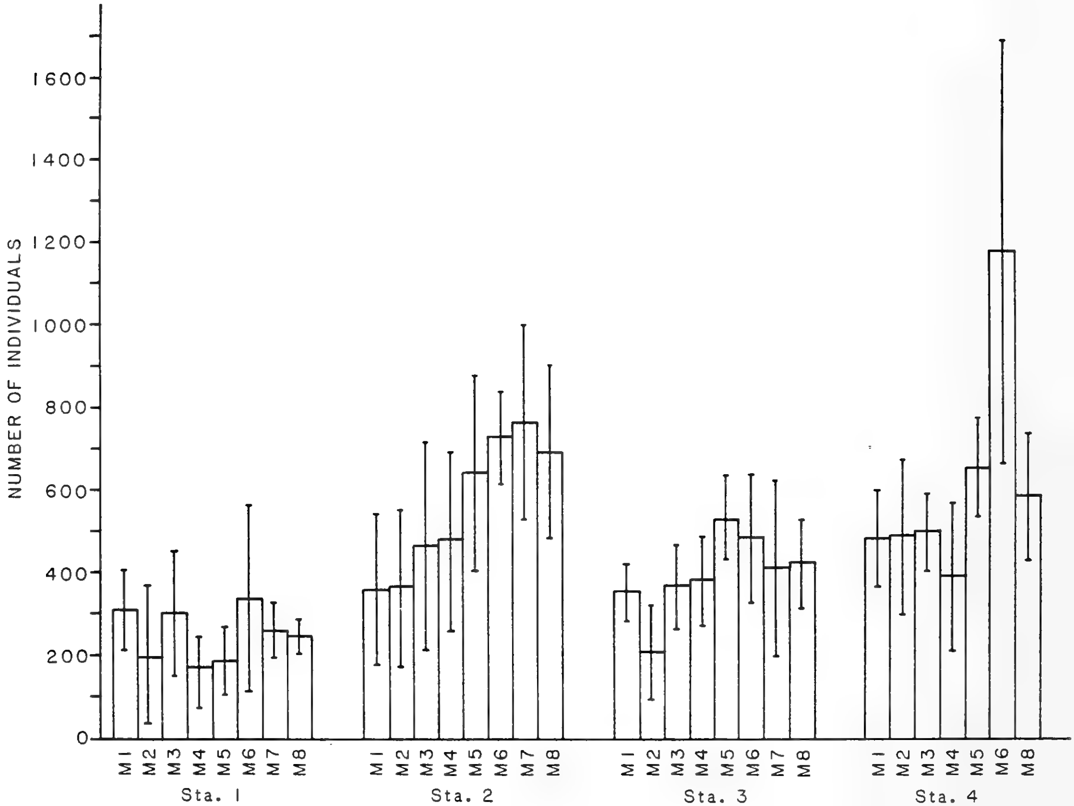


FIGURE 3. AVERAGE NUMBER OF INDIVIDUALS PER 0.04m2 ± ONE STANDARD DEVIATION AT REGIONAL STATIONS 1 THROUGH 4 FOR ALL EIGHT SAMPLING SEASONS.

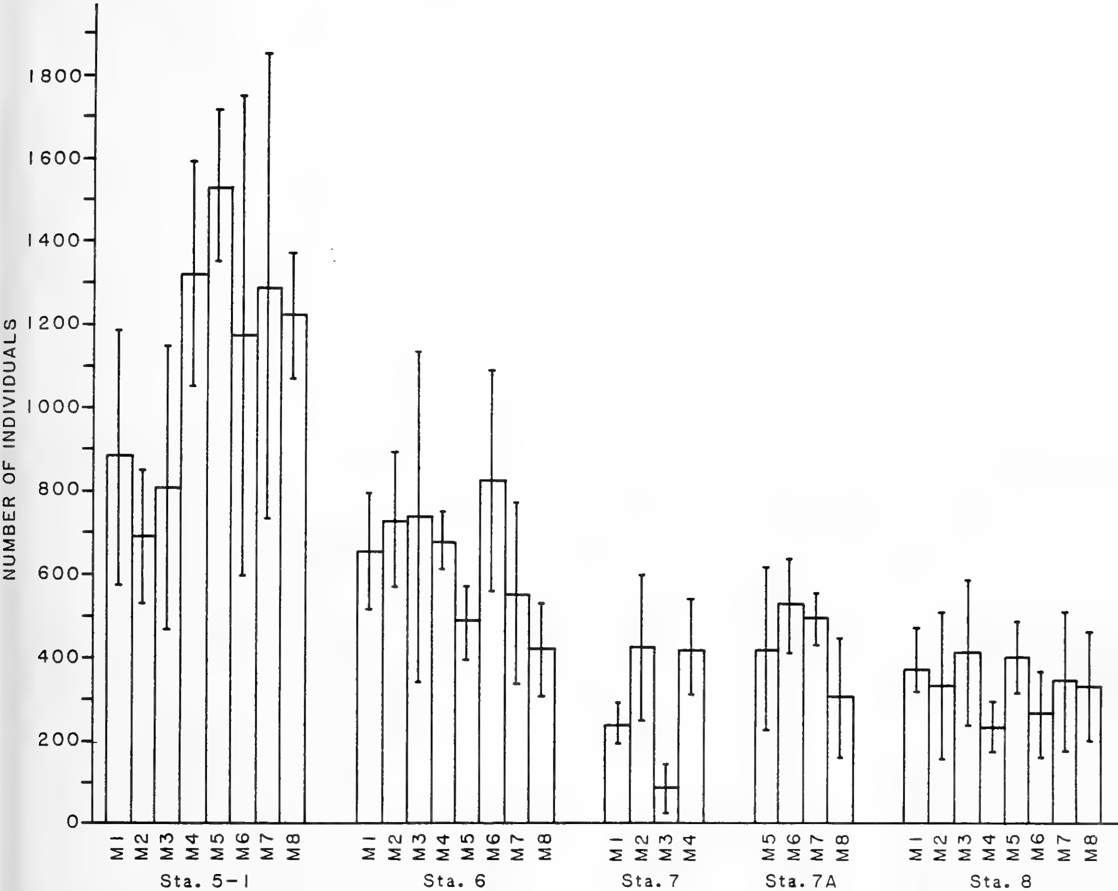


FIGURE 4. AVERAGE NUMBER OF INDIVIDUALS PER 0.04m2 ± ONE STANDARD DEVIATION AT REGIONAL STATIONS 5-1 THROUGH 8 FOR ALL EIGHT SAMPLING CRUISES.

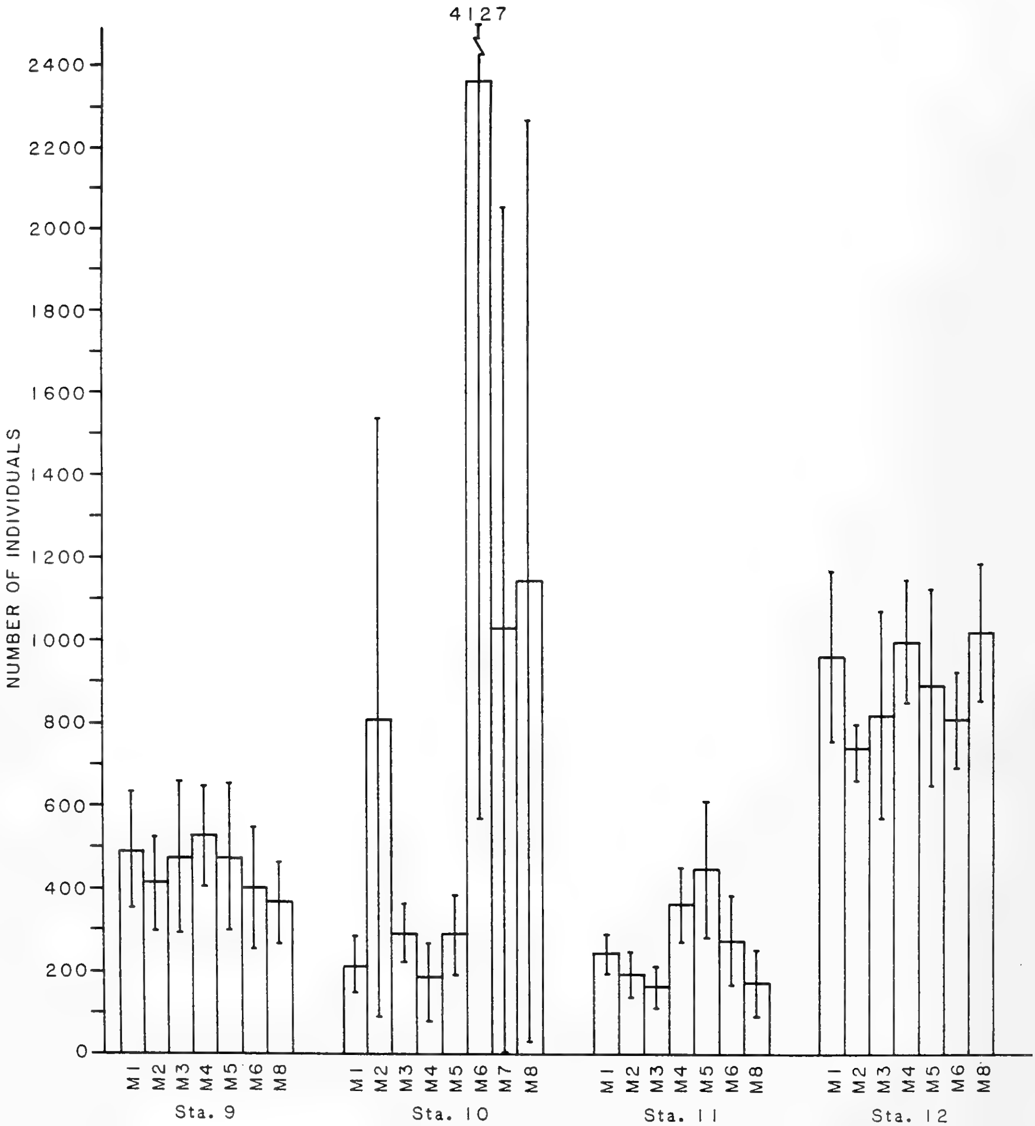


FIGURE 5. AVERAGE NUMBER OF INDIVIDUALS PER 0.04m2 ± ONE STANDARD DEVIATION AT REGIONAL STATIONS 9 THROUGH 12 FOR ALL EIGHT SAMPLING SEASONS.

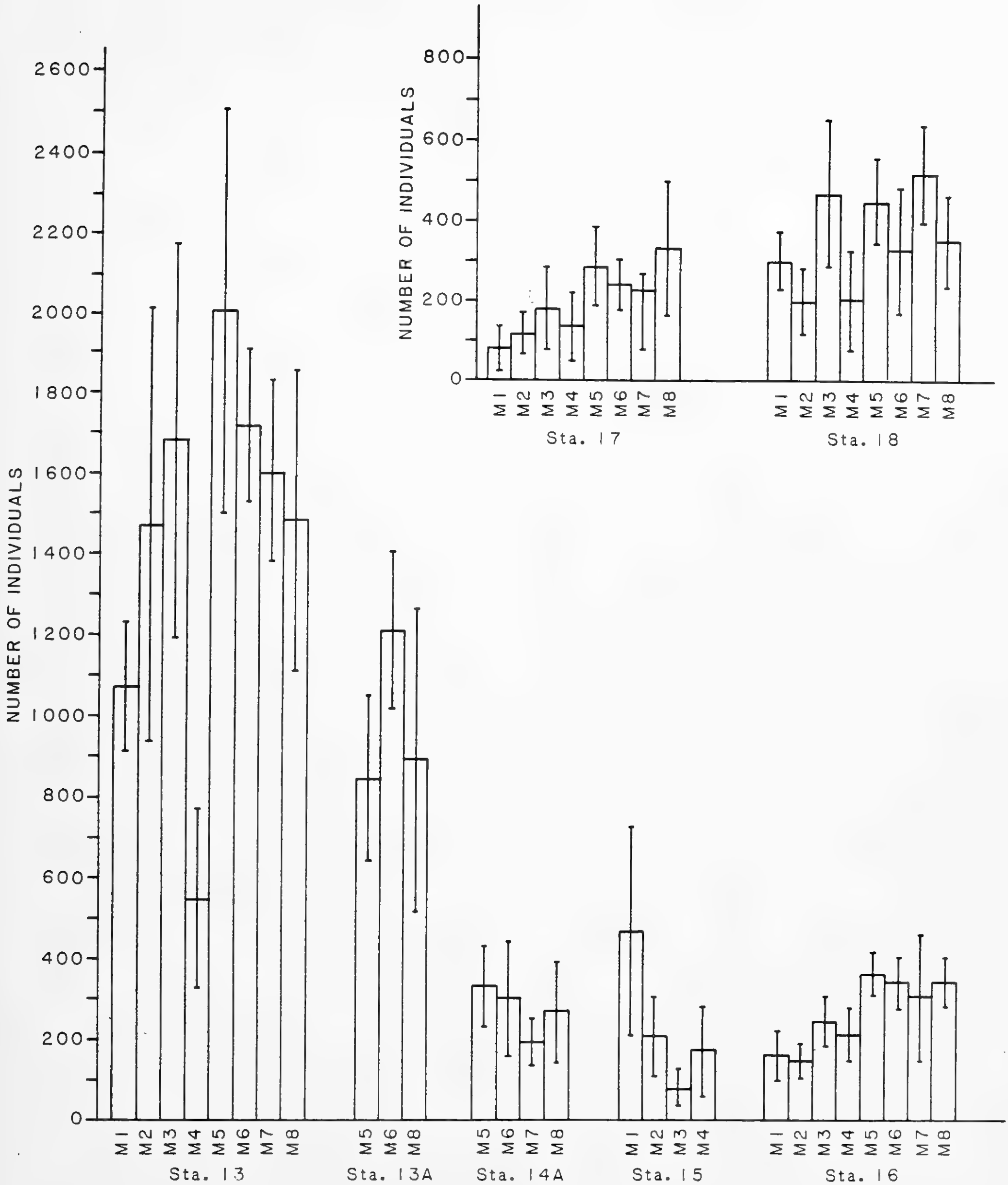


FIGURE 6. AVERAGE NUMBER OF INDIVIDUALS PER $0.04m^2$ $\pm$ ONE STANDARD DEVIATION AT REGIONAL STATIONS 13 THROUGH 18 FOR ALL EIGHT SAMPLING SEASONS.

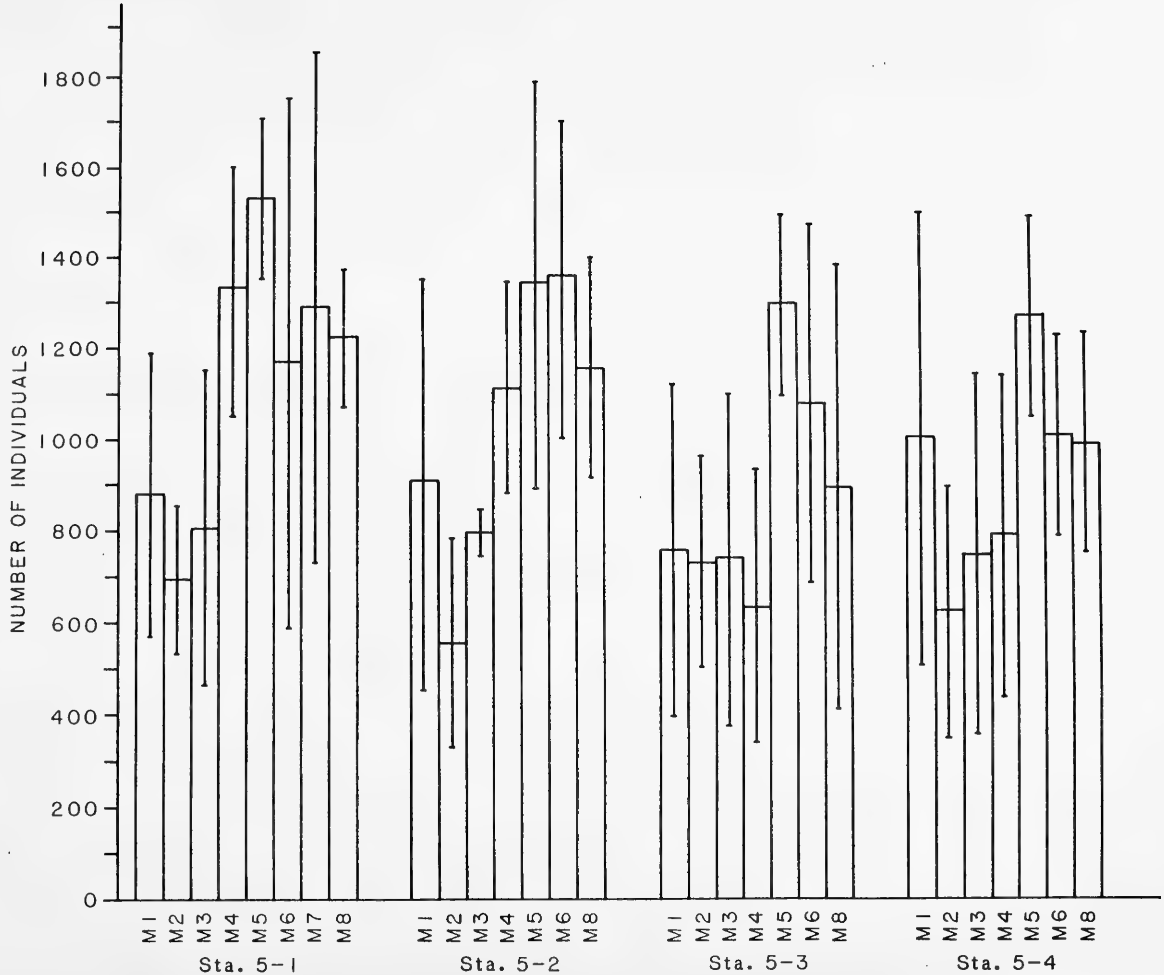


FIGURE 7. AVERAGE NUMBER OF INDIVIDUALS PER $0.04 m^2 \pm$ ONE STANDARD DEVIATION AT SITE-SPECIFIC STATIONS 5-1 THROUGH 5-4 FOR ALL SAMPLING SEASONS.

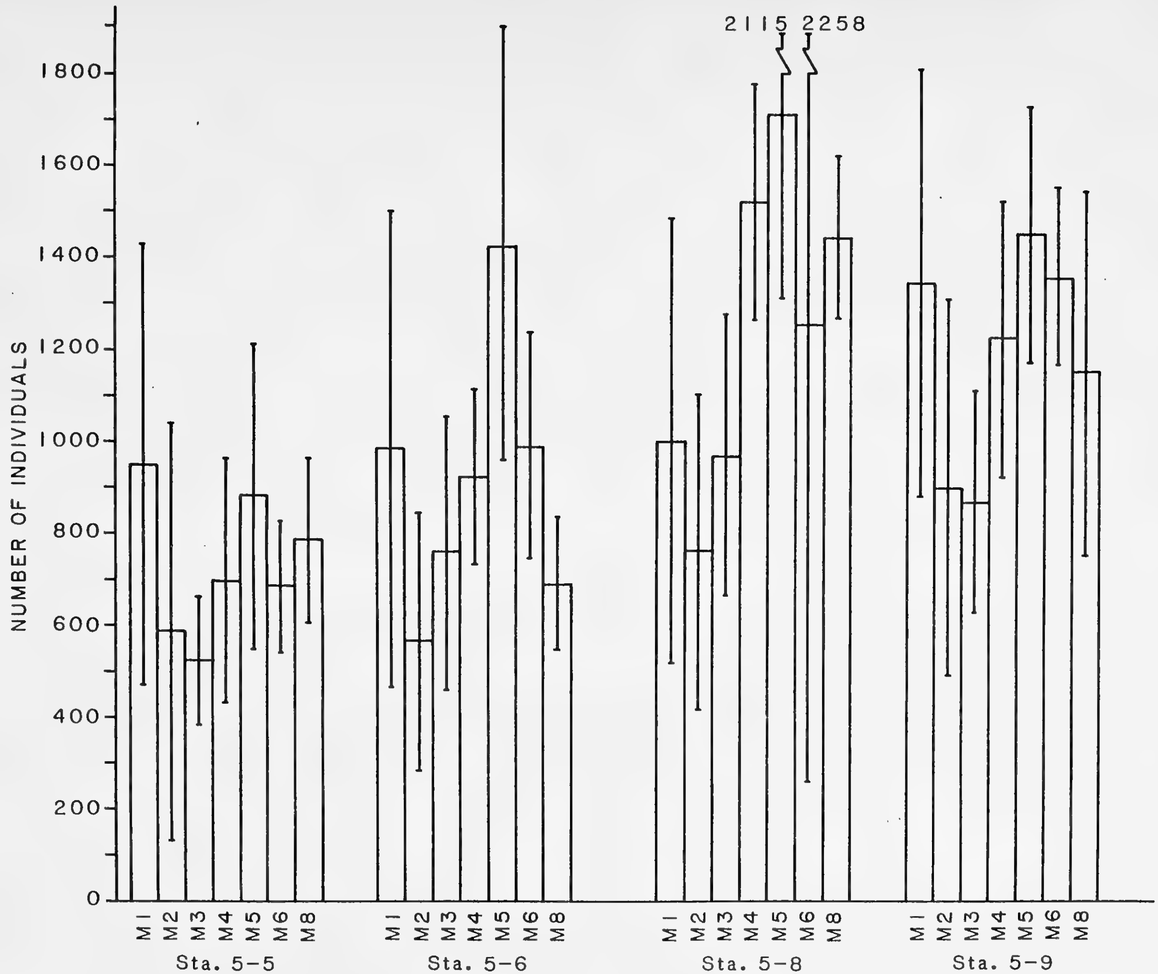


FIGURE 8. AVERAGE NUMBER OF INDIVIDUALS PER 0.04 $m^2 \pm$ ONE STANDARD DEVIATION AT SITE-SPECIFIC STATIONS 5-5, 5-6, 5-8 AND 5-9 FOR ALL SAMPLING SEASONS.

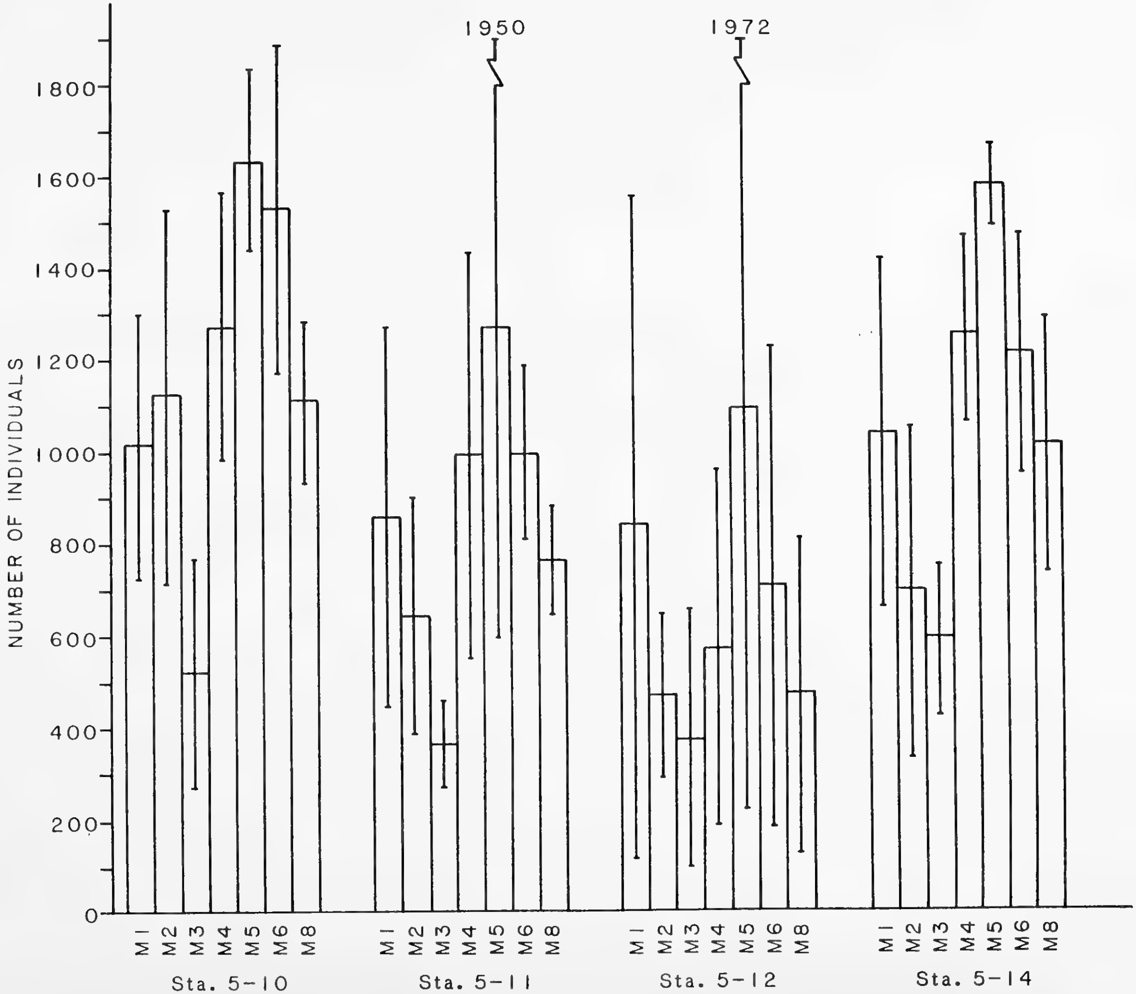


FIGURE 9. AVERAGE NUMBER OF INDIVIDUALS PER $0.04 m^2 \pm$ ONE STANDARD DEVIATION AT SITE-SPECIFIC STATIONS 5-10, 5-11, 5-12 AND 5-14 FOR ALL SAMPLING SEASONS.

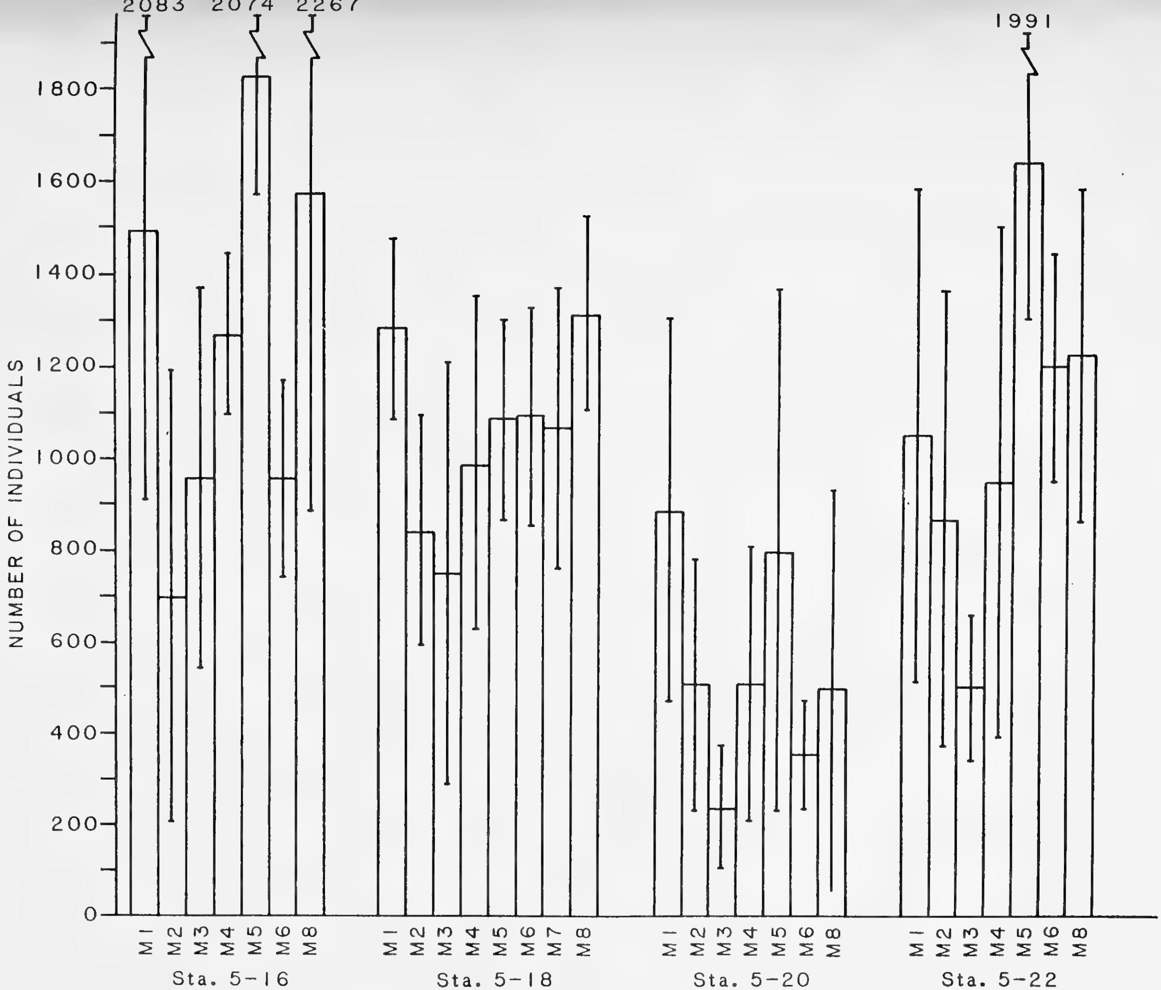


FIGURE 10. AVERAGE NUMBER OF INDIVIDUALS PER $0.04m^2 \pm$ ONE STANDARD DEVIATION AT SITE-SPECIFIC STATIONS 5-16, 5-18, 5-20 AND 5-22 FOR ALL SAMPLING SEASONS.

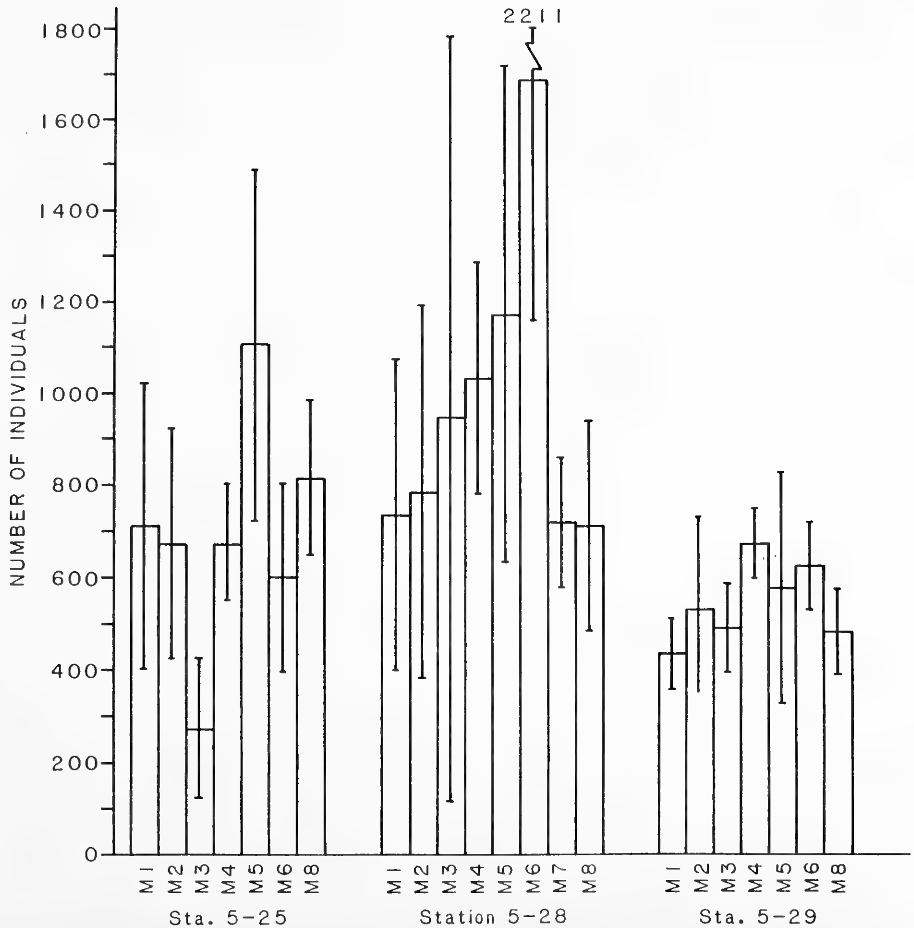


FIGURE 11. AVERAGE NUMBER OF INDIVIDUALS PER $0.04m^2$ ± ONE STANDARD DEVIATION AT SITE-SPECIFIC STATIONS 5-25, 5-28 AND 5-29 FOR ALL SAMPLING SEASONS.

(E), and Hurlbert's rarefaction or number of species expected per 50, 100, or 1,000 individuals, are presented in Appendix E, Table E-1. Similar parameters, with the exception of species expected per 50 individuals, are given in Table E-2 for all site-specific stations.

Figure 12 shows the number of species present in six combined replicates at seven stations for each of the eight sampling cruises. All of the stations plotted, and in fact, all stations sampled, with the exception of Station 9, exhibited an increase in the total number of species recorded from M4 to M5. At Station 9, this parameter was very stable, with 112 species recorded in M4 and 111 species recorded in M5 (Table E-1).

The patterns in diversity observed in samples from M1 through M4 held for M5 through M8 as well. The shallower Stations 1, 4, and 10 had the lowest diversity, while Stations 3, 16, and 17, all at 100 m or deeper, had the highest diversity. Figure 13 shows the Shannon-Wiener (H') diversity over time at seven stations, including the two rig site stations, Stations 5-1 and 16. It should be noted that at both of those stations, the H' value remained stable over all eight sampling seasons. The differences that were noted at Stations 5-1 and 16 are not statistically significant. Greater variability in this parameter over time was seen at Stations 4 and 12. At Station 4, which exhibited the lowest diversity overall of the stations sampled, the H' values were similar from M1 through M5, but fell from 2.46 on M5 to 1.11 on M6. No samples were collected on M7, due to the short cruise, but H' diversity rose to 2.00 for M8 samples. At Station 12, a general trend of slightly increasing diversity was reversed when values peaked at 4.21 on M5, then fell to 3.97 (M6) and 2.53 (M8). At Station 13, although total densities declined sharply from M3 to M4, the H' diversity value essentially did not change, and has been fairly stable at an average value of about 3.60.

Trends similar to those seen for the Shannon-Wiener index were also seen for species per 100 individuals (Figure 14) and species per 1,000 individuals (Figure 15) at the same seven stations.

5.1.5 Biomass

Wet-weight biomass was measured to the nearest 0.001 g for each species collected, and for the 0.5 mm and 0.3 mm screen fractions separately. The average

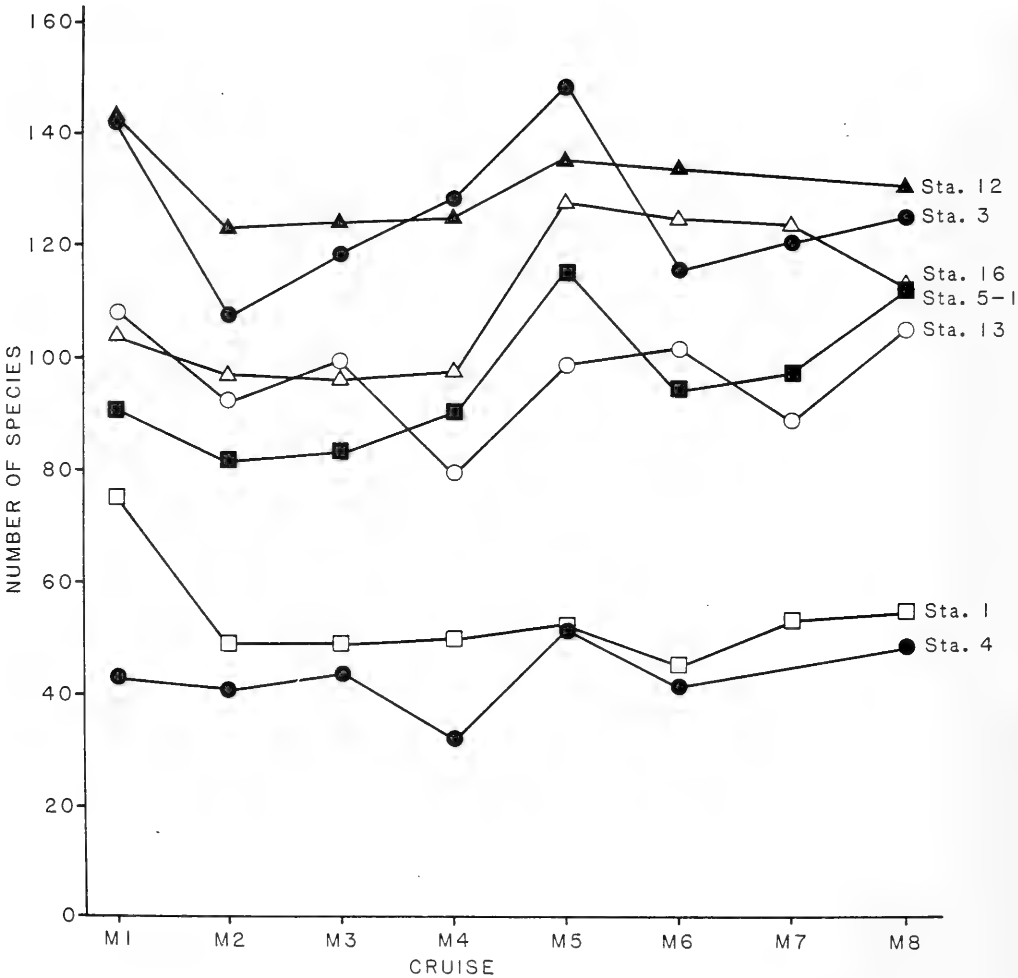


FIGURE 12. NUMBER OF SPECIES PRESENT IN SIX COMBINED REPLICATES (SPECIES PER 0.24 m^2) FOR EACH SAMPLING OCCASION AT SELECTED GEORGES BANK MONITORING STATIONS.

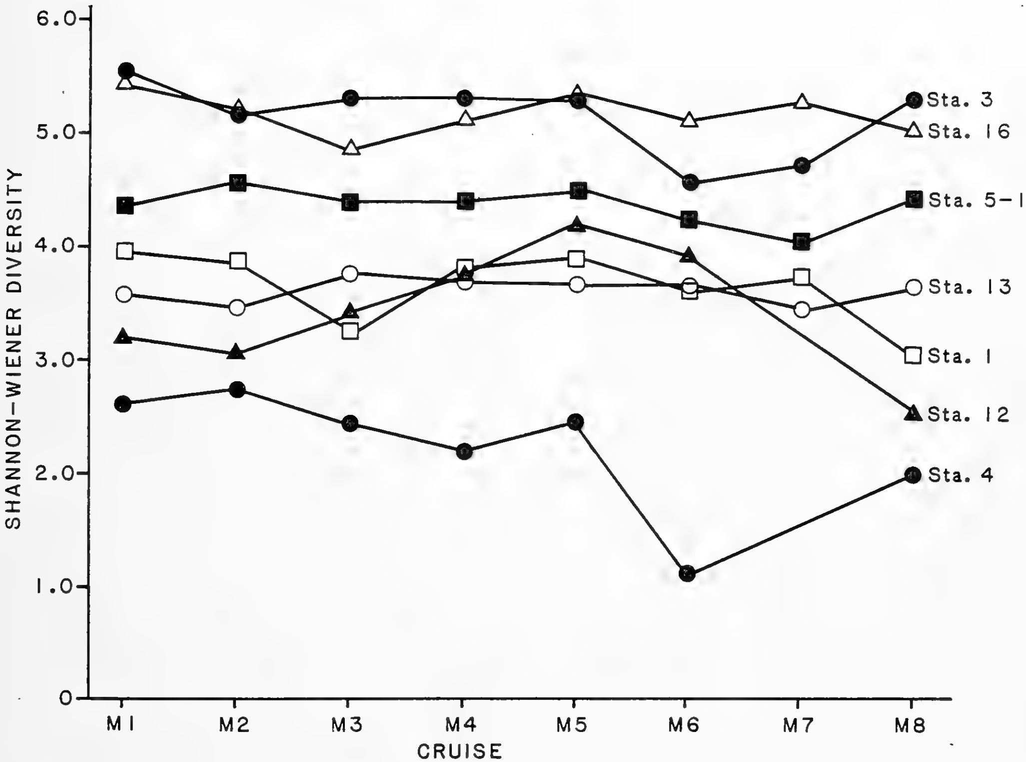


FIGURE 13. SHANNON-WIENER DIVERSITY (H') FOR EACH SAMPLING OCCASION AT SELECTED GEORGES BANK MONITORING STATIONS.

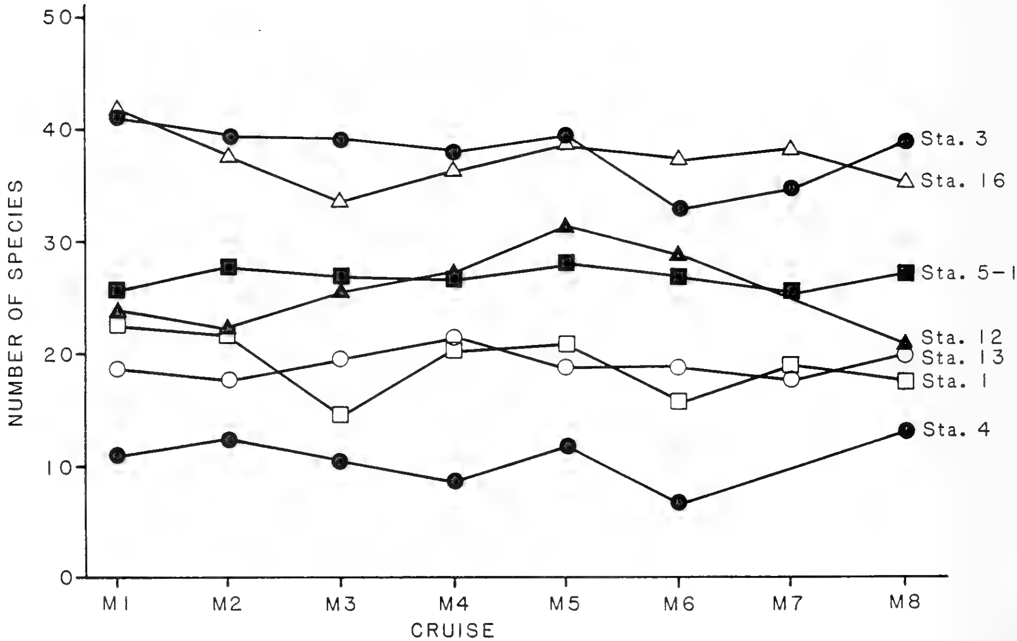


FIGURE 14. NUMBER OF SPECIES PER 100 INDIVIDUALS FOR EACH SAMPLING OCCASION AT SELECTED GEORGES BANK MONITORING STATIONS.

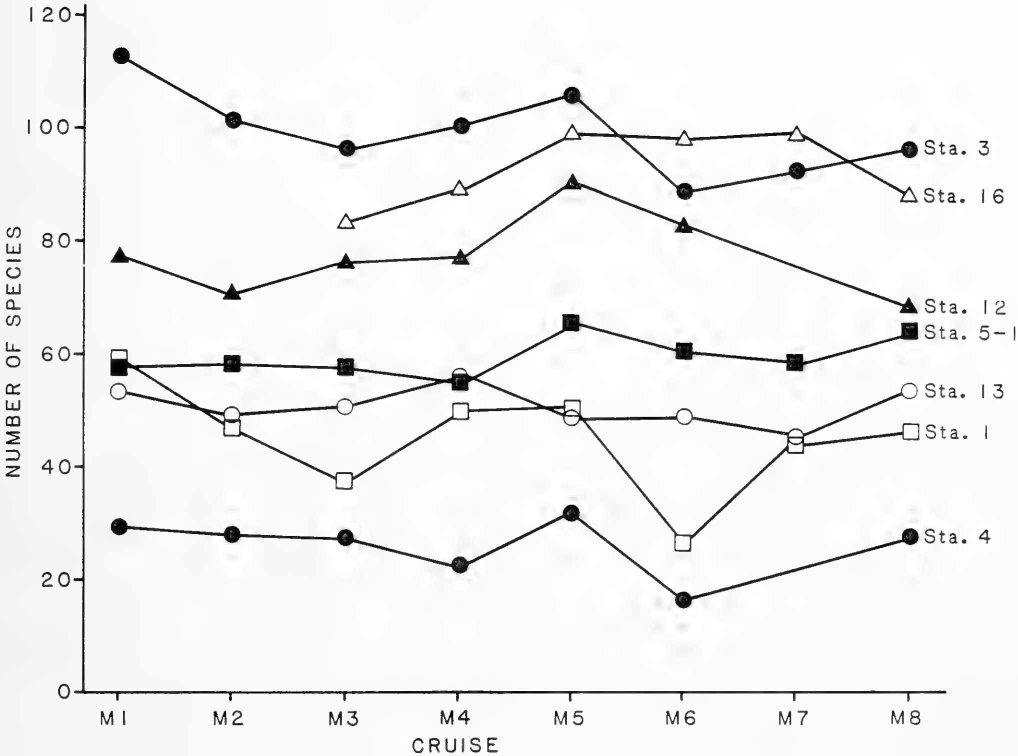


FIGURE 15. NUMBER OF SPECIES PER 1,000 INDIVIDUALS FOR EACH SAMPLING OCCASION AT SELECTED GEORGES BANK MONITORING STATIONS. INSUFFICIENT SAMPLE SIZE PRECLUDED CALCULATION OF THIS PARAMETER FOR STATION 16, M1 AND M2.

biomass, plus or minus one standard deviation, for arthropods, polychaetes, molluscs and echinoderms for each sampling occasion is given in Tables 7, 8, 9, and 10, respectively. It is clear that the biomass values for molluscs are not reasonable estimates for that taxon; the weight of the shell material and the inclusion of the occasional large specimen of Arctica islandica diminish a meaningful interpretation of these data. The calcareous endoskeletons of echinoderms were also included in the biomass estimates, and therefore that taxon, along with the molluscs, dominated the biomass. In Year 3, ash-free dry weight will be measured for three replicates from each station for one cruise, and correlated with wet-weight. This should result in a better estimation of secondary productivity.

5.2 Cluster Analysis and Population Patterns of Selected Species

5.2.1 Regional Stations

5.2.1.1 Cluster Analysis. Despite the two very different methods, NESS and percent similarity, used to cluster summed replicate data from the regional stations, the patterns obtained are similar (Figures 16 and 17, and Appendix I). Each station, with the exception of the Block 410 Stations 16 and 17, is discrete, regardless of date sampled. Since percent similarity emphasizes common species, a fourth root transformation of the data gives close to the same result as NESS at 200 individuals (Appendix I, Figure I-1).

Within sampling dates, replicates from each station consistently group together, indicating the excellent replication within stations (Appendix I). Samples from a particular station cluster with each other before grouping with other stations.

There is never a time of year when the benthic communities of individual stations are not distinct from surrounding stations. The deep-water stations are the most similar to each other. In a line from west to east, Stations 18, 16, and 17 are spaced at 2 km intervals. Station 17 for M1 is not shown on the diagram using NESS since there were fewer than 400 individuals in the combined sample. Increased numbers of Ampelisca agassizi occur in the finer sediments at Station 18 where the mean grain size (and fauna) is similar to that at Station 8. Stations 16, 17, and 18 group together and link up with the two canyon head Stations 7 and 9 and Stations 6 and 12, the western pair of stations along

TABLE 7. AVERAGE WET-WEIGHT BIOMASS IN GRAMS PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION OF ARTHROPODS AT REGIONAL STATIONS, M1 THROUGH M8.

Station	Cruise M1	M2	M3	M4	M5	M6	M7	M8
1	0.46 ± 0.63	0.19 ± 0.21	0.14 ± 0.05	0.12 ± 0.02	0.10 ± 0.04	0.18 ± 0.09	0.18 ± 0.09	0.16 ± 0.18
2	0.45 ± 0.55	0.15 ± 0.12	0.07 ± 0.06	0.20 ± 0.13	0.27 ± 0.07	0.40 ± 0.22	0.66 ± 0.54	0.86 ± 0.55
3	0.16 ± 0.10	0.12 ± 0.15	0.07 ± 0.02	0.15 ± 0.03	0.40 ± 0.21	0.16 ± 0.07	0.37 ± 0.47	0.26 ± 0.40
4	0.35 ± 0.44	0.26 ± 0.11	0.61 ± 0.70	0.21 ± 0.06	0.26 ± 0.12	0.14 ± 0.06	*	0.17 ± 0.07
5-1	0.28 ± 0.07	0.16 ± 0.03	0.07 ± 0.04	0.36 ± 0.13	0.33 ± 0.12	0.15 ± 0.14	0.34 ± 0.21	0.25 ± 0.08
6	0.53 ± 0.13	0.39 ± 0.12	0.48 ± 0.25	0.42 ± 0.10	0.23 ± 0.12	0.31 ± 0.13	0.11 ± 0.06	0.19 ± 0.08
7	0.27 ± 0.38	0.09 ± 0.14	0.05 ± 0.04	0.01 ± 0.00	*	*	*	*
7A	*	*	*	*	0.14 ± 0.08	0.11 ± 0.06	0.05 ± 0.02	0.05 ± 0.05
8	0.32 ± 0.47	0.11 ± 0.04	0.17 ± 0.09	0.10 ± 0.04	0.18 ± 0.07	0.14 ± 0.05	0.10 ± 0.07	0.11 ± 0.07
9	0.60 ± 0.39	0.25 ± 0.03	0.17 ± 0.06	0.43 ± 0.16	0.33 ± 0.10	0.14 ± 0.03	*	0.16 ± 0.08
10	0.10 ± 0.05	0.12 ± 0.07	0.14 ± 0.07	0.04 ± 0.04	0.27 ± 0.38	0.06 ± 0.04	0.10 ± 0.11	0.10 ± 0.06
11	0.05 ± 0.01	0.03 ± 0.02	0.04 ± 0.05	0.02 ± 0.01	0.13 ± 0.10	0.02 ± 0.03	*	0.11 ± 0.11
12	0.62 ± 0.14	0.64 ± 0.12	0.71 ± 0.18	0.92 ± 0.32	1.02 ± 0.11	0.43 ± 0.14	*	0.44 ± 0.09
13	0.31 ± 0.40	0.10 ± 0.06	0.22 ± 0.09	0.05 ± 0.03	0.33 ± 0.11	0.23 ± 0.14	0.35 ± 0.08	0.58 ± 0.30
13A	*	*	*	*	0.28 ± 0.06	0.27 ± 0.06	*	0.56 ± 0.20
14A	*	*	*	*	0.07 ± 0.16	.004 ± .005	.003 ± .001	.004 ± .005
15	0.18 ± 0.42	0.02 ± 0.01	0.05 ± 0.03	0.02 ± 0.02	*	*	*	*
16	0.02 ± 0.02	0.15 ± 0.14	0.02 ± 0.02	0.02 ± 0.01	.006 ± 0.04	0.02 ± 0.02	0.06 ± 0.14	0.03 ± 0.02
17	0.01 ± 0.01	0.04 ± 0.06	0.04 ± 0.07	0.03 ± 0.04	0.04 ± 0.05	0.01 ± 0.01	0.03 ± 0.03	0.02 ± 0.01
18	0.36 ± 0.38	0.12 ± 0.03	0.16 ± 0.06	0.12 ± 0.10	0.34 ± 0.14	0.12 ± 0.07	0.22 ± 0.06	0.22 ± 0.10

*No Sample Taken

TABLE 8. AVERAGE WET-WEIGHT BIOMASS IN GRAMS PER 0.04 $m^2 \pm$ ONE STANDARD DEVIATION OF POLYCHAETES AT REGIONAL STATIONS M1 THROUGH M8.

Station	Cruise							
	M1	M2	M3	M4	M5	M6	M7	M8
1	0.36 ± 0.39	0.11 ± 0.14	0.05 ± 0.02	0.35 ± 0.68	0.10 ± 0.05	0.04 ± 0.04	0.08 ± 0.11	0.17 ± 0.16
2	0.43 ± 0.41	0.54 ± 0.46	0.21 ± 0.17	0.22 ± 0.09	0.24 ± 0.04	0.23 ± 0.08	0.41 ± 0.24	0.32 ± 0.17
3	0.26 ± 0.08	0.24 ± 0.16	0.35 ± 0.13	0.49 ± 0.14	0.79 ± 0.24	0.53 ± 0.18	0.65 ± 0.36	0.54 ± 0.21
4	0.12 ± 0.08	0.15 ± 0.09	0.13 ± 0.10	0.14 ± 0.21	0.14 ± 0.07	0.16 ± 0.19	*	0.16 ± 0.13
5-1	0.59 ± 0.23	0.77 ± 0.41	0.32 ± 0.09	0.71 ± 0.15	0.71 ± 0.17	0.62 ± 0.35	0.57 ± 0.23	0.81 ± 0.33
6	1.13 ± 0.99	1.98 ± 3.54	0.66 ± 0.18	0.82 ± 0.29	0.86 ± 0.49	1.02 ± 0.25	0.54 ± 0.16	0.74 ± 0.18
7	1.48 ± 1.11	0.40 ± 0.19	0.50 ± 0.23	0.49 ± 0.39	*	*	*	*
7A	*	*	*	*	0.63 ± 0.30	0.67 ± 0.23	0.36 ± 0.11	0.36 ± 0.12
8	0.21 ± 0.06	0.27 ± 0.16	0.15 ± 0.06	0.18 ± 0.10	0.48 ± 0.40	0.11 ± 0.07	0.21 ± 0.13	0.35 ± 0.16
9	0.38 ± 0.42	0.23 ± 0.05	0.10 ± 0.02	0.21 ± 0.10	0.14 ± 0.05	0.16 ± 0.10	*	0.28 ± 0.12
10	0.66 ± 1.20	0.19 ± 0.12	0.15 ± 0.14	0.27 ± 0.26	0.19 ± 0.34	0.22 ± 0.12	0.20 ± 0.23	0.94 ± 1.03
11	0.39 ± 0.40	0.20 ± 0.12	0.47 ± 0.16	0.47 ± 0.31	0.67 ± 0.52	0.24 ± 0.10	*	0.34 ± 0.23
12	0.47 ± 0.22	0.29 ± 0.21	0.33 ± 0.20	0.47 ± 0.14	0.47 ± 0.22	0.48 ± 0.35	*	0.52 ± 0.38
13	0.99 ± 0.84	0.42 ± 0.12	0.65 ± 0.30	0.40 ± 0.35	1.26 ± 0.54	0.55 ± 0.17	0.57 ± 0.41	0.83 ± 0.36
13A	*	*	*	*	0.30 ± 0.14	0.44 ± 0.43	*	0.46 ± 0.21
14A	*	*	*	*	0.53 ± 0.31	0.47 ± 0.35	0.39 ± 0.21	0.45 ± 0.18
15	0.13 ± 0.14	0.06 ± 0.03	0.01 ± 0.01	0.04 ± 0.02	*	*	*	*
16	0.15 ± 0.06	0.53 ± 0.36	0.22 ± 0.15	0.12 ± 0.08	0.33 ± 0.18	0.25 ± 0.15	0.27 ± 0.11	0.26 ± 0.09
17	0.22 ± 0.19	0.22 ± 0.19	0.14 ± 0.16	0.22 ± 0.18	0.14 ± 0.07	0.23 ± 0.09	0.12 ± 0.09	0.41 ± 0.25
18	1.00 ± 1.19	0.18 ± 0.12	0.14 ± 0.07	0.12 ± 0.07	0.22 ± 0.12	0.14 ± 0.07	0.13 ± 0.05	0.21 ± 0.04

*No Sample Taken

TABLE 9. AVERAGE WET-WEIGHT BIOMASS IN GRAMS ± ONE STANDARD DEVIATION OF MOLLUSCS AT REGIONAL STATIONS, M1 THROUGH M8. SHELLS OF MOLLUSCS ARE INCLUDED IN THE BIOMASS GIVEN.

Station	Cruise							
	M1	M2	M3	M4	M5	M6	M7	M8
1	0.32 ± 0.44	.002 ± .003	37.7 ± 59.1	3.83 ± 9.35	65.9 ± 81.1	0.03 ± 0.06	26.9 ± 65.9	0.09 ± 0.19
2	.004 ± .005	0.02 ± 0.04	0.15 ± 0.38	0.01 ± 0.02	0.01 ± 0.01	0.01 ± 0.01	51.1 ± 80.1	0.09 ± 0.18
3	1.34 ± 2.71	0.04 ± 0.06	15.7 ± 32.7	5.29 ± 12.8	0.04 ± 0.05	0.06 ± 0.03	1.98 ± 3.84	1.10 ± 2.43
4	12.1 ± 8.79	0.01 ± 0.01	60.2 ± 87.6	32.0 ± 30.6	0.20 ± 0.47	0.07 ± 0.14	*	54.3 ± 91.4
5-1	0.17 ± 0.40	0.01 ± 0.02	20.6 ± 50.5	0.01 ± 0.01	0.04 ± 0.06	0.05 ± 0.05	0.03 ± 0.03	0.09 ± 0.11
6	0.32 ± 0.42	1.31 ± 2.92	0.40 ± 0.47	0.12 ± 0.22	0.05 ± 0.05	0.07 ± 0.05	0.27 ± 0.42	0.05 ± 0.06
7	1.43 ± 3.33	0.03 ± 0.03	0.05 ± 0.09	0.09 ± 0.18	*	*	*	*
7A	*	*	*	*	0.18 ± 0.32	0.29 ± 0.10	0.54 ± 0.24	0.40 ± 0.45
8	0.04 ± 0.02	0.01 ± 0.00	.004 ± .006	0.03 ± 0.05	0.06 ± 0.06	.003 ± .003	0.03 ± 0.03	0.02 ± 0.01
9	0.37 ± 0.81	0.03 ± 0.26	0.03 ± 0.05	0.03 ± 0.02	0.01 ± 0.01	1.74 ± 4.22	*	0.05 ± 0.03
10	.003 ± .003	18.0 ± 44.0	1.30 ± 3.03	.001 ± .002	.003 ± .003	.004 ± .004	.002 ± .003	35.7 ± 84.9
11	52.0 ± 48.3	1.14 ± 2.63	44.9 ± 77.8	3.64 ± 5.67	5.52 ± 13.2	5.58 ± 13.6	*	13.2 ± 31.0
12	1.10 ± 1.51	1.49 ± 3.45	0.06 ± 0.05	1.35 ± 2.21	0.12 ± 0.04	2.20 ± 3.25	*	1.04 ± 2.24
13	0.08 ± 0.04	0.07 ± 0.05	0.05 ± 0.03	0.07 ± 0.08	0.09 ± 0.11	0.10 ± 0.10	0.22 ± 0.39	0.10 ± 0.09
13A	*	*	*	*	0.25 ± 0.18	0.23 ± 0.20	*	0.29 ± 0.11
14A	*	*	*	*	0.03 ± 0.02	0.03 ± 0.03	0.01 ± 0.01	0.03 ± 0.02
15	0.71 ± 1.73	0.08 ± 0.11	0.11 ± 0.27	0.36 ± 0.83	*	*	*	*
16	0.21 ± 0.39	0.06 ± 0.12	39.1 ± 95.7	0.10 ± 0.16	0.70 ± 1.58	0.04 ± 0.03	0.05 ± 0.04	0.02 ± 0.01
17	0.02 ± 0.02	0.02 ± 0.02	0.03 ± 0.03	0.08 ± 0.16	0.03 ± 0.03	0.04 ± 0.04	0.02 ± 0.02	0.05 ± 0.04
18	0.05 ± 0.04	0.03 ± 0.02	0.05 ± 0.03	0.02 ± 0.02	0.09 ± 0.08	0.05 ± 0.04	0.06 ± 0.02	0.06 ± 0.06

*No Sample Taken

TABLE 10. AVERAGE WET-WEIGHT BIOMASS IN GRAMS PER 0.04 $m^2 \pm$ ONE STANDARD DEVIATION OF ECHINODERMS AT REGIONAL STATIONS, M1-M8.

STATION	CRUISE M1	M2	M3	M4	M5	M6	M7	M8
1	16.07 ± 18.12	2.89 ± 7.08	31.83 ± 34.10	19.92 ± 19.48	25.21 ± 26.67	14.00 ± 27.11	26.81 ± 24.16	12.16 ± 15.06
2	0.75 ± 0.59	0.39 ± 0.33	0.91 ± 0.72	1.10 ± 0.74	0.89 ± 0.80	3.74 ± 5.55	2.10 ± 3.69	2.69 ± 3.66
3	0.51 ± 1.21	.004 ± .005	0.01 ± 0.01	2.08 ± 3.76	0.95 ± 2.29	0.02 ± 0.02	0.64 ± 1.55	0.88 ± 1.39
4	33.10 ± 19.59	6.77 ± 8.07	18.02 ± 18.37	11.89 ± 8.62	18.51 ± 14.94	4.86 ± 5.99	*	9.87 ± 8.82
5-1	0.61 ± 0.48	0.40 ± 0.65	0.17 ± 0.38	0.04 ± 0.04	0.85 ± 0.96	0.10 ± 0.11	0.09 ± 0.13	0.24 ± 0.50
6	.004 ± .002	0.61 ± 1.49	0.33 ± 0.77	.003 ± .004	.007 ± .006	.001 ± .002	0.01 ± .004	0.02 ± 0.05
7	.001 ± .001	0.00 ± 0.00	.001 ± .002	.004 ± .004	*	*	*	*
7A	*	*	*	*	.003 ± .005	0.02 ± 0.06	0.01 ± 0.03	0.05 ± 0.12
8	0.01 ± 0.02	0.06 ± 0.10	0.86 ± 2.05	.002 ± 0.01	0.01 ± .004	0.00 ± .001	0.00 ± 0.00	0.03 ± 0.04
9	0.01 ± 0.02	0.01 ± 0.02	0.07 ± 0.14	0.01 ± 0.03	0.01 ± 0.01	.004 ± 0.01	*	.004 ± 0.01
10	16.33 ± 18.53	23.52 ± 18.07	31.55 ± 23.35	21.13 ± 26.49	29.24 ± 42.64	27.78 ± 33.86	16.34 ± 20.02	33.41 ± 22.23
11	0.24 ± 0.42	0.15 ± 0.30	0.14 ± 0.36	0.14 ± 0.22	0.01 ± 0.01	0.02 ± 0.05	*	.003 ± 0.01
12	1.02 ± 1.54	1.58 ± 1.75	0.02 ± 0.03	2.30 ± 3.63	0.41 ± 0.82	1.07 ± 2.42	*	0.91 ± 1.94
13	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.30 ± 0.73	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
13A	*	*	*	*	0.63 ± 0.33	0.46 ± 0.20	*	0.95 ± 0.40
14A	*	*	*	*	0.21 ± 0.13	0.12 ± 0.06	0.04 ± 0.04	0.04 ± 0.04
15	0.00 ± 0.00	0.00 ± 0.00	0.28 ± 0.68	0.92 ± 1.12	*	*	*	*
16	0.24 ± 0.59	0.05 ± 0.04	1.25 ± 2.00	0.02 ± 0.02	0.37 ± 0.75	0.02 ± 0.02	0.01 ± 0.02	0.01 ± 0.01
17	0.26 ± 0.54	0.01 ± 0.01	0.01 ± 0.03	0.17 ± 0.44	0.05 ± 0.04	0.08 ± 0.12	0.17 ± 0.39	0.02 ± 0.02
18	.003 ± .004	0.02 ± 0.03	0.05 ± 0.07	0.01 ± 0.01	0.07 ± 0.15	0.01 ± 0.01	0.02 ± 0.01	0.03 ± 0.03

*No Sample Taken

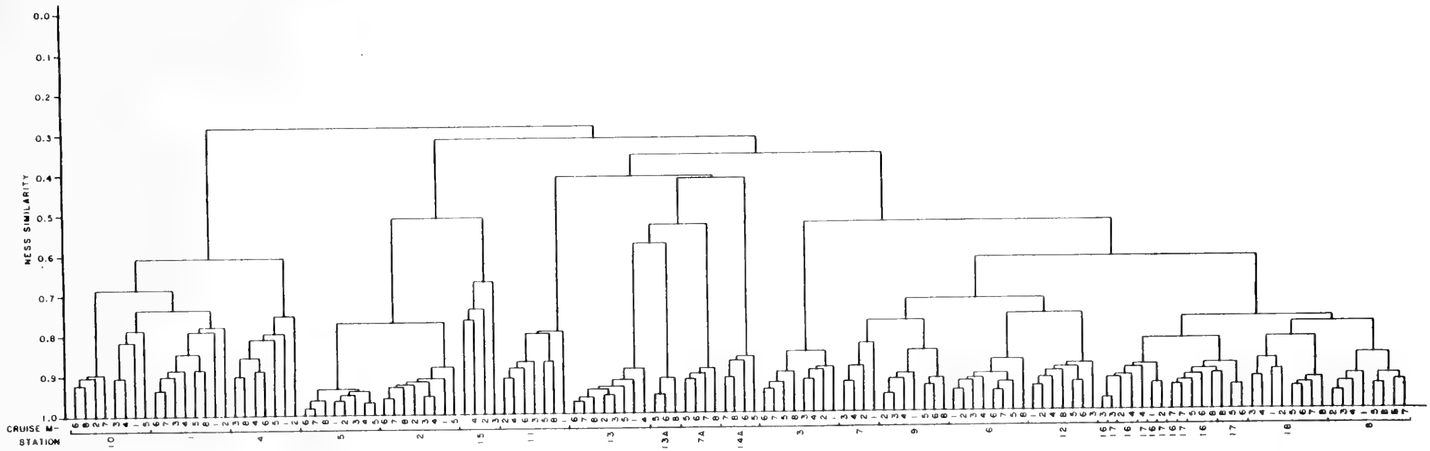


FIGURE 16. SUMMED REPLICATES OF M1 THROUGH M8 REGIONAL STATIONS CLUSTERED BY NESS AT 200 INDIVIDUALS AND GROUP AVERAGE SORTING.

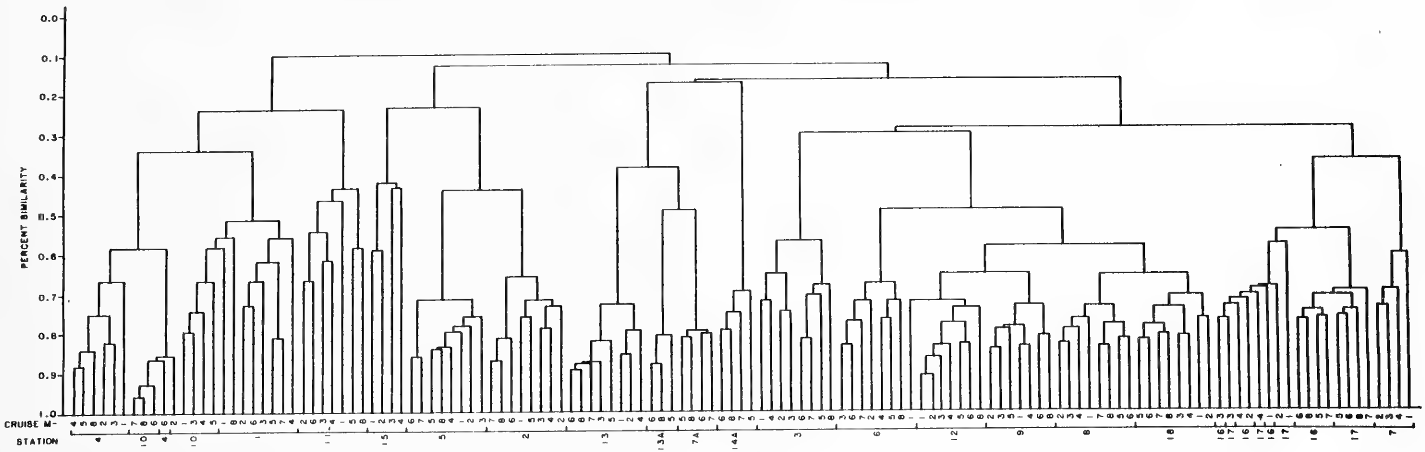


FIGURE 17. SUMMED REPLICATES OF M1 THROUGH M8 REGIONAL STATIONS CLUSTERED BY PERCENT SIMILARITY AND GROUP AVERAGE SORTING.

the 100 m contour. Station 3, the remaining 100 m contour station with slightly coarser sediments, completes the deep-water sandy sediment grouping.

Within these deep-water stations (i.e. Stas. 3, 6, 8, 9 and Block 410), the Year 1 samples consistently cluster together, separately from the Year 2 samples. It was possible to resolve subtle differences between years because of the remarkable similarity of samples at these sites within each year.

The next grouping includes the original Mud Patch Station 13 and three new stations established in Year 2 (Stations 7A, 13A, 14A) in areas of muddy sediment where high rates of sedimentation and deposition of discharged material are expected. The faunal similarity of these four stations is related to their high silt-clay content even though Stations 13 and 13A are at 72 and 76 m depth, and Stations 7A and 14A are both at approximately 165 m depth. At depths of 70-85 m, Stations 2 and 5 group together, but the slightly deeper Station 11, which has finer sediments, shows affinities with the high silt-clay stations. Station 15 at 37 m depth at the top of the Bank has greater faunal similarity with Stations 2 and 5 than with the shallower 60 m contour Stations 1, 4 and 10. These relationships are illustrated by Figure 18.

5.2.1.2 Population Patterns of Selected Species. In the Final Report for Year I (Battelle and W.H.O.I., 1983), the average densities of several species were plotted for each of the four sampling periods at the Block 410 stations and at the Mud Patch Station 13. The data for eight seasonal samples are now presented in Figures 19 to 29. Drilling began at Station 16 shortly after the completion of Cruise M1, and continued until March, 1982, between Cruises M3 and M4.

Ampelisca agassizi continued to be far more abundant at Station 18 than at either Station 16 or 17 (Figure 19). The average density in Year 2 of this species at Station 18 was slightly higher than the average density in Year 1. Gravid females and recently hatched young were most abundant in Year 1 in February (M3) which was also the sampling period with the highest densities. During Year 2, the highest percentage of gravid females was collected in July (M5) and the highest percentage of juveniles in February (M7). The highest percentage of juveniles coincided with the peak population density, indicating that recruitment of young is important to the seasonal population fluctuations of this species.

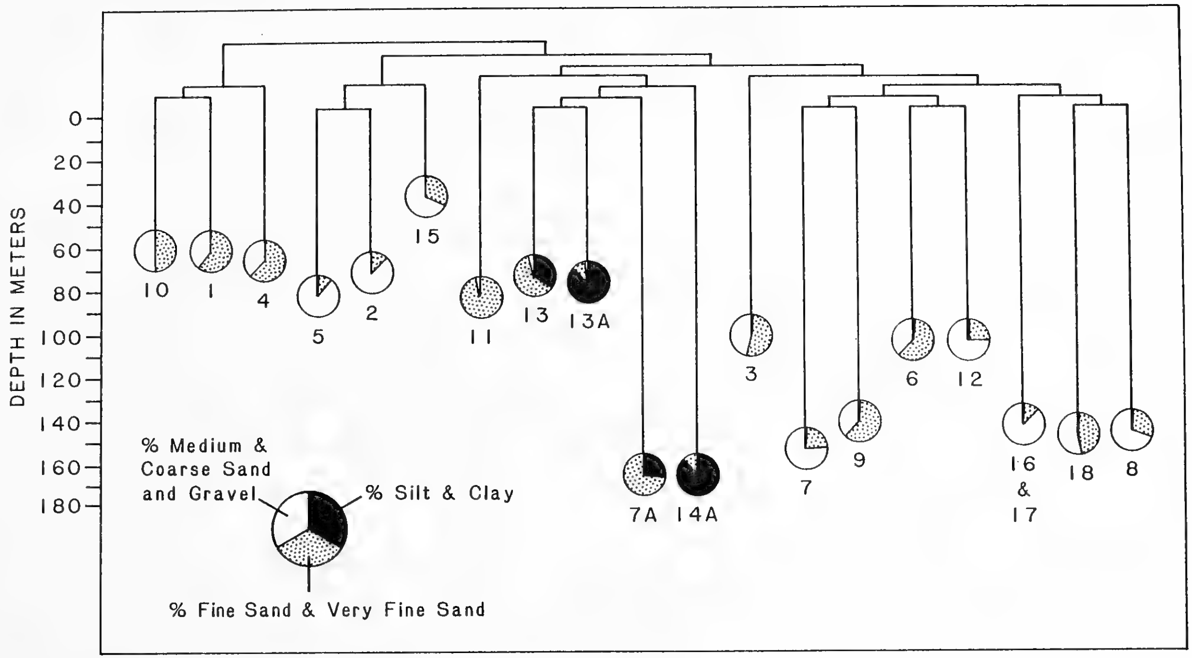


FIGURE 18. DIAGRAMMATIC REPRESENTATION OF STATION CLUSTERS DELIMITED BY NESS (SEE FIGURE 16), STATION DEPTH IN METERS (INDICATED BY LENGTH OF LINE), AND SEDIMENT GRAIN SIZE COMPOSITION (INDICATED BY PIE DIAGRAM).

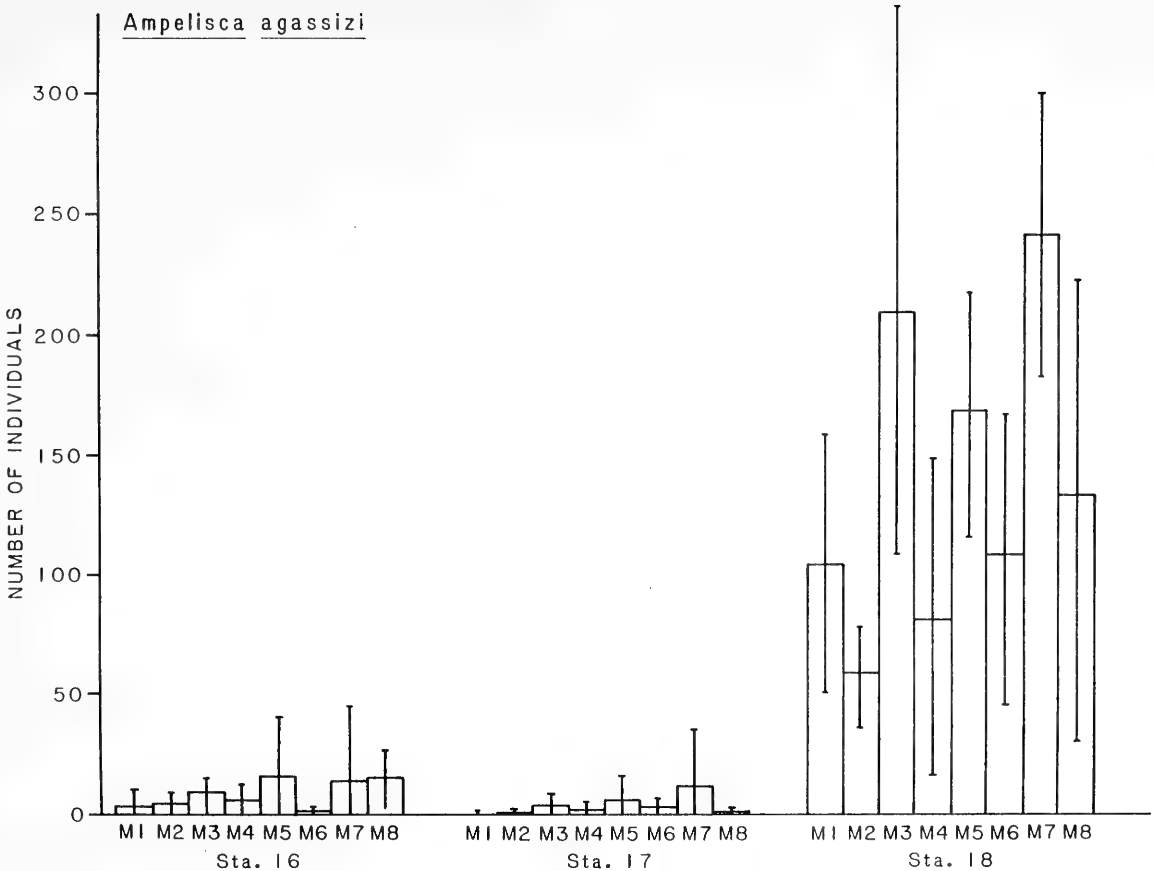


FIGURE 19. AVERAGE NUMBER OF INDIVIDUALS OF Ampelisca agassizi PER 0.04 m^2 ± ONE STANDARD DEVIATION AT THE BLOCK 410 STATIONS.

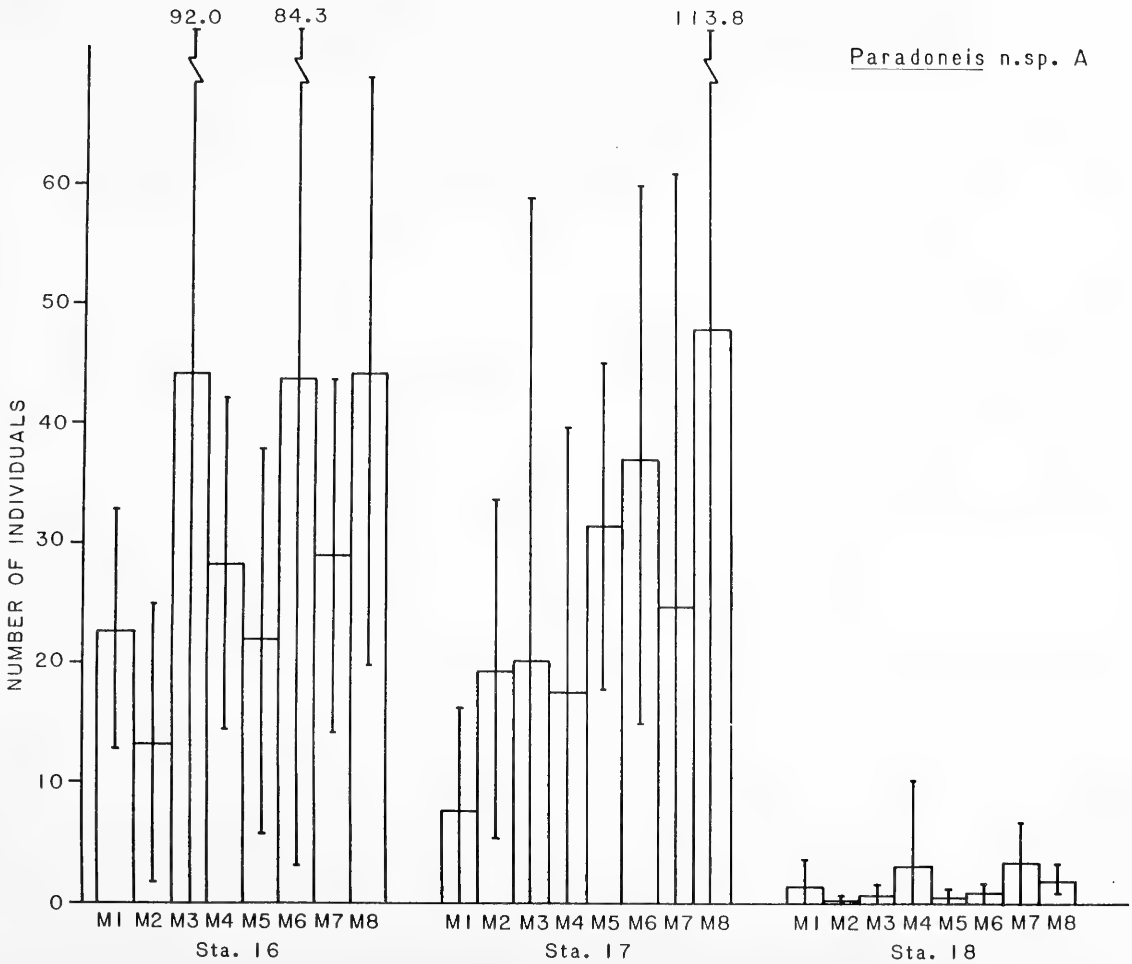


FIGURE 20. AVERAGE NUMBER OF INDIVIDUALS OF Paradoneis n. sp. A PER 0.04 m^2 ± ONE STANDARD DEVIATION AT THE BLOCK 410 STATIONS.

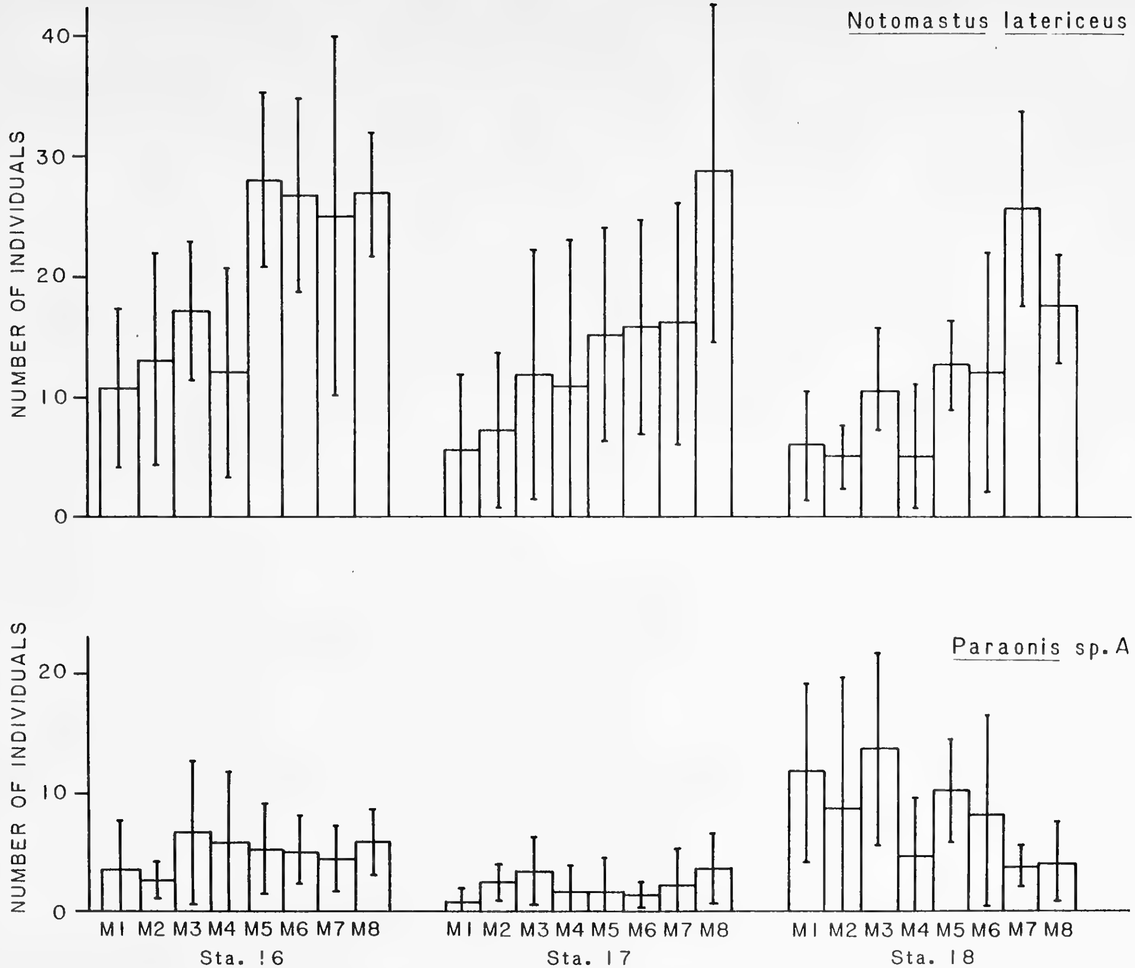


FIGURE 21. AVERAGE NUMBER OF INDIVIDUALS OF Notomastus latericeus AND Paraonis sp. A PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT THE BLOCK 410 STATIONS.

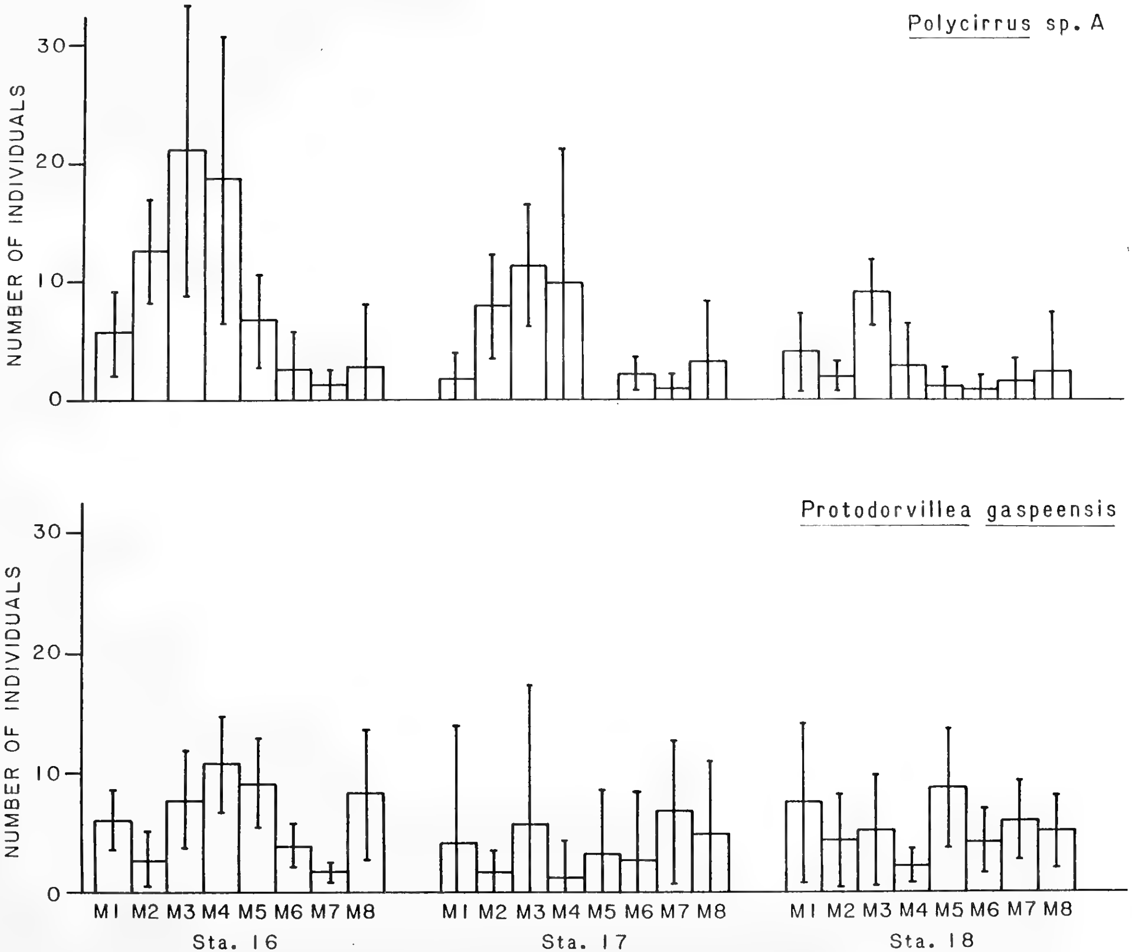


FIGURE 22. AVERAGE NUMBER OF INDIVIDUALS OF Polycirrus sp. A and Protodorvillea gaspeensis PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION FOR THE BLOCK 410 STATIONS.

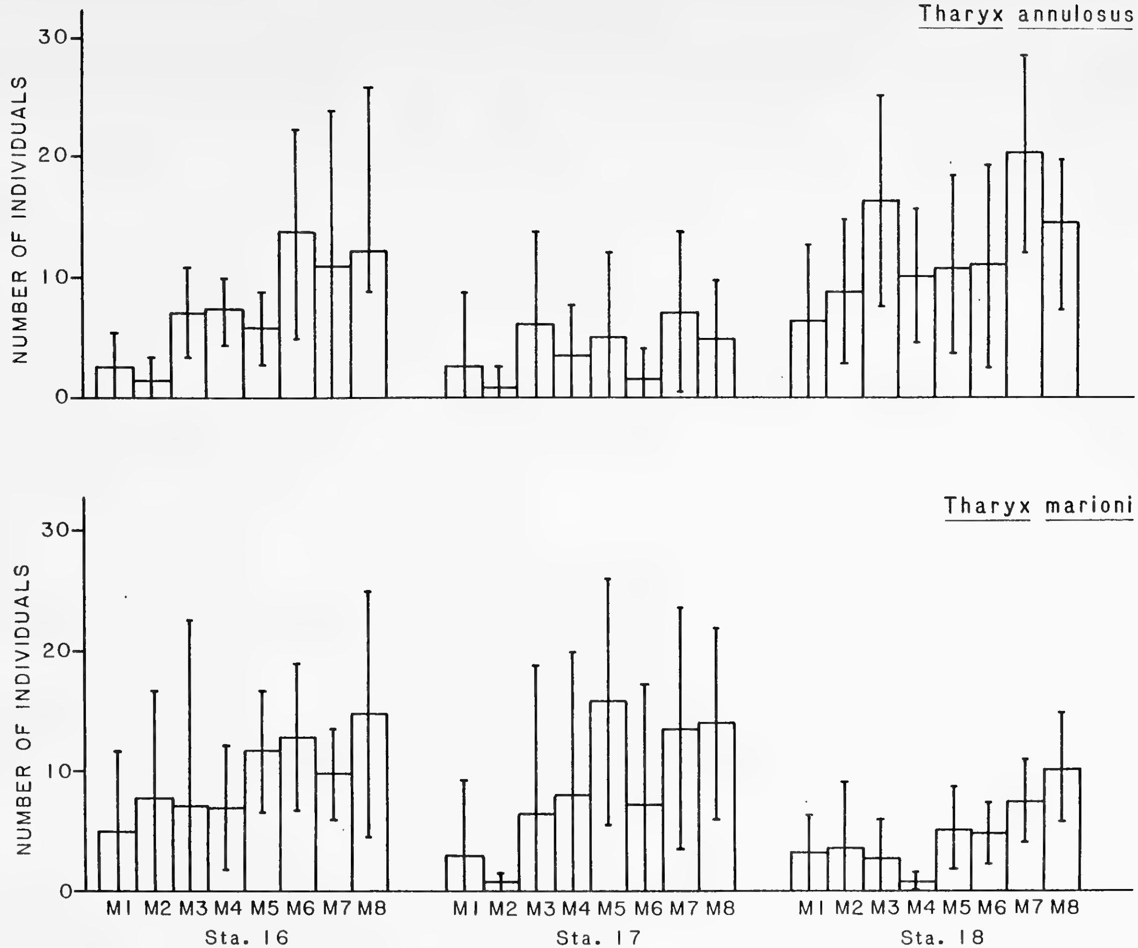


FIGURE 23. AVERAGE NUMBER OF INDIVIDUALS OF Tharyx annulosus AND T. marioni PER 0.04 m^2 ± ONE STANDARD DEVIATION AT THE BLOCK 410 STATIONS.

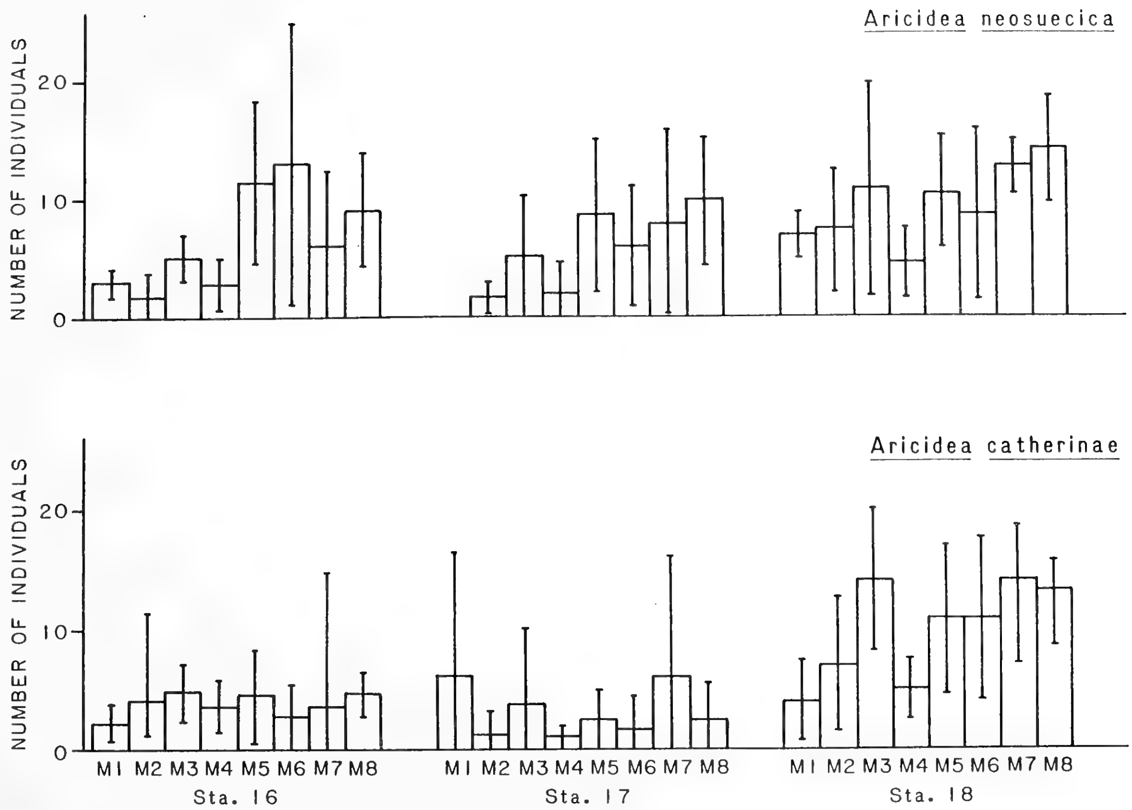
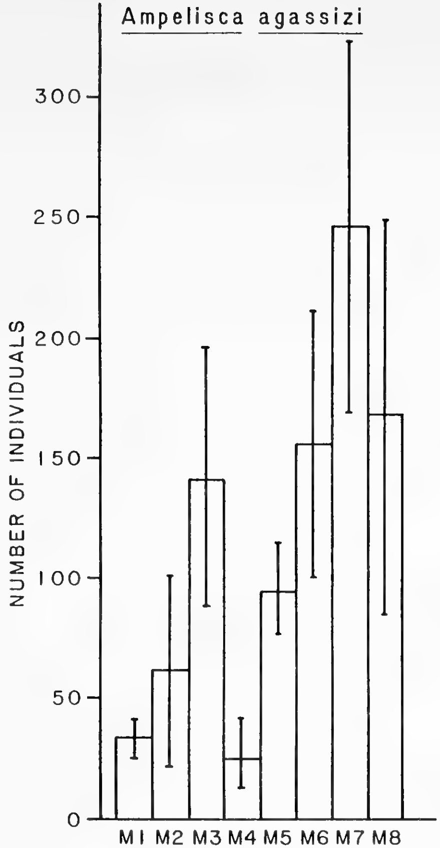


FIGURE 24. AVERAGE NUMBER OF INDIVIDUALS OF *Aricidea neosuecica* AND *A. catherinae* PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT THE BLOCK 410 STATIONS.



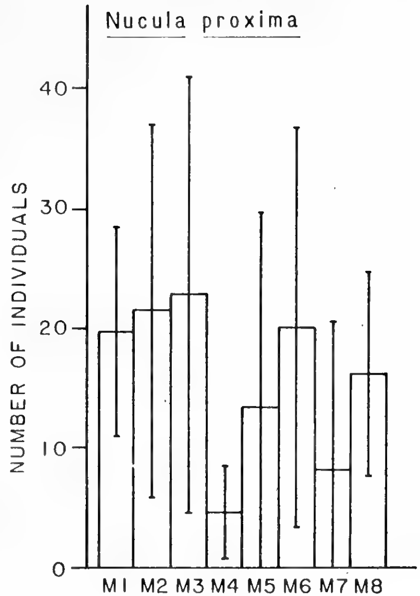


FIGURE 25. AVERAGE NUMBER OF INDIVIDUALS OF THE AMPHIPOD Ampelisca agassizi AND THE BIVALVE Nucula proxima PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT REGIONAL STATION 13.

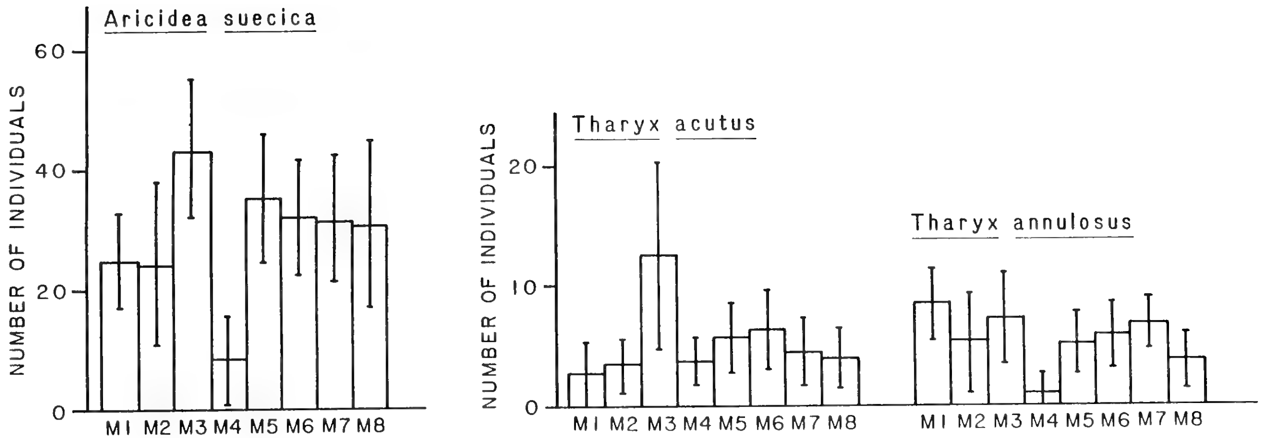


FIGURE 26. AVERAGE NUMBER OF INDIVIDUALS OF THREE POLYCHAETE SPECIES PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT REGIONAL STATION 13.

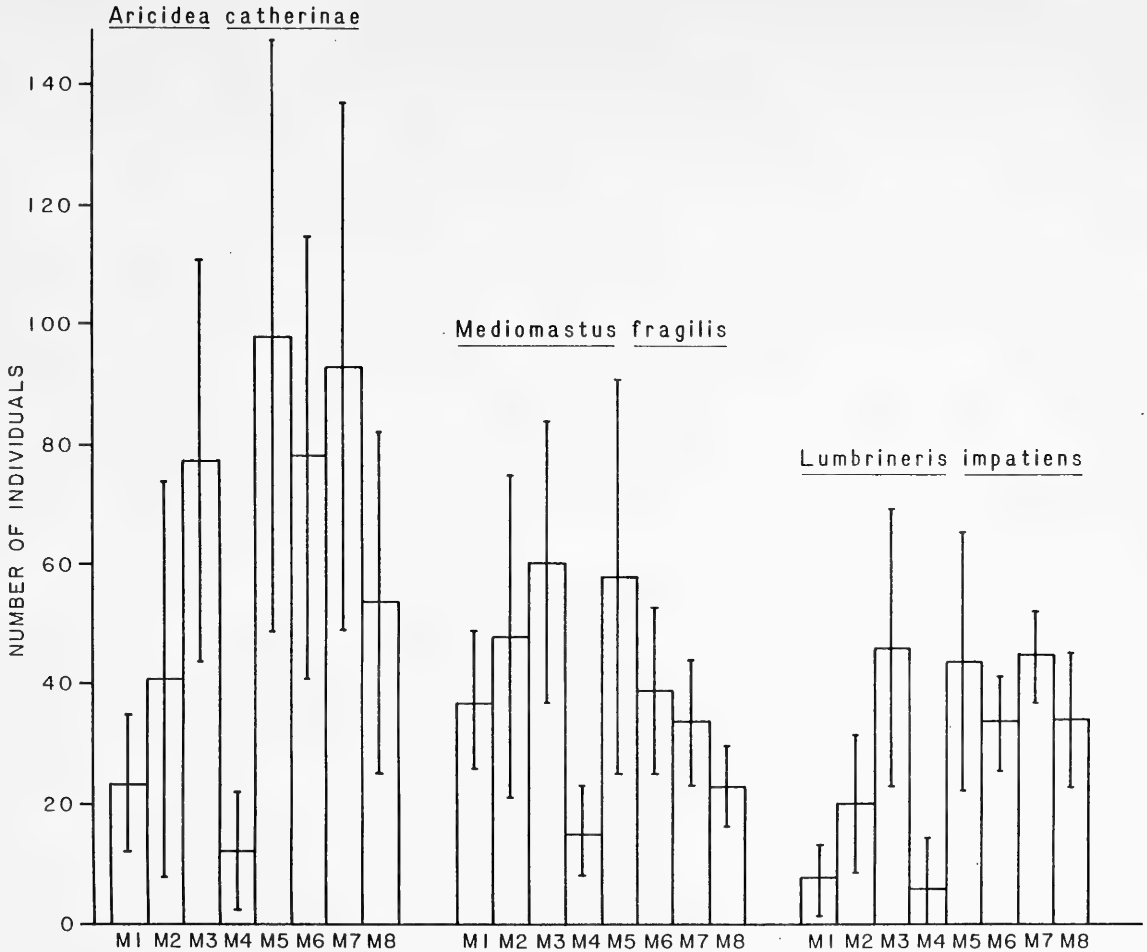


FIGURE 27. AVERAGE NUMBER OF INDIVIDUALS OF THREE POLYCHAETE SPECIES PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT REGIONAL STATION 13.

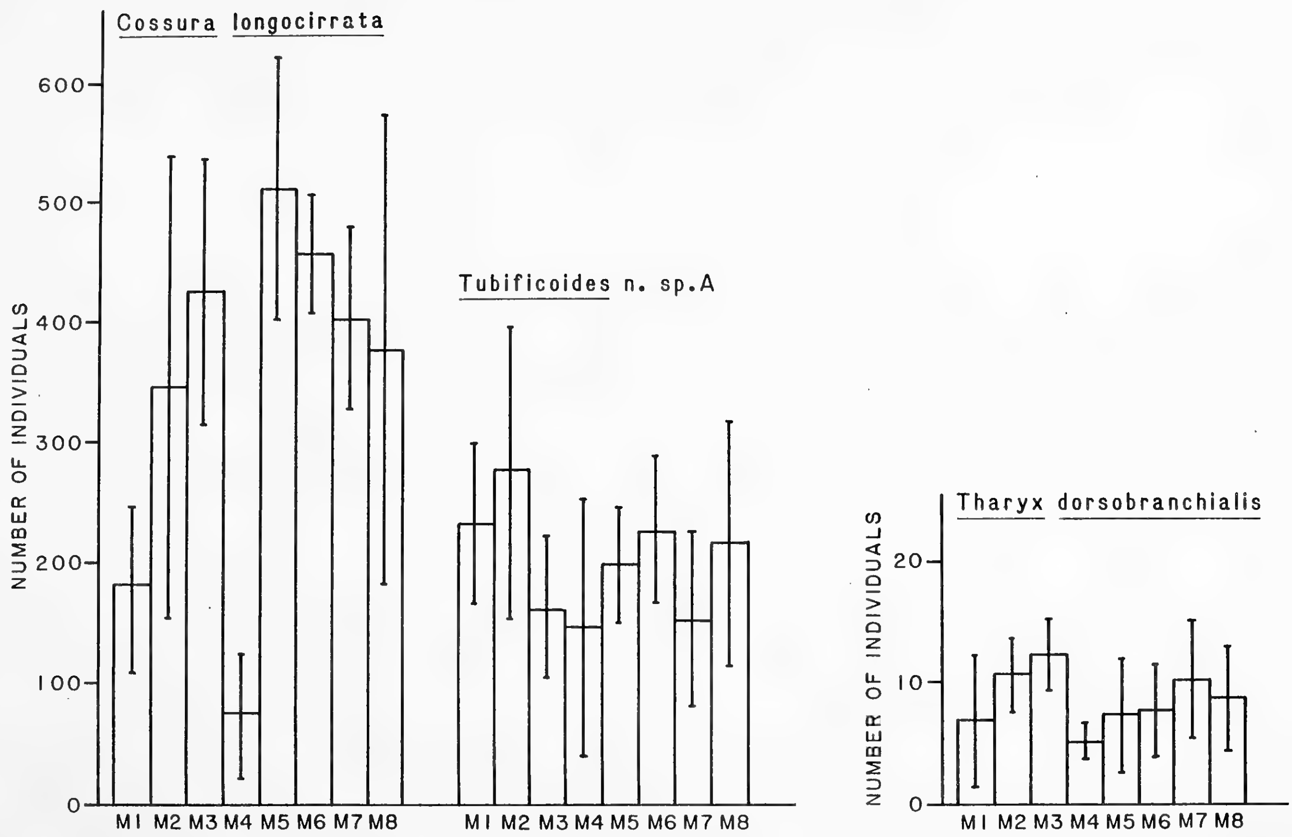


FIGURE 28. AVERAGE NUMBER OF INDIVIDUALS OF TWO POLYCHAETE SPECIES AND ONE OLIGOCHAETE SPECIES PER 0.04 $m^2 \pm$ ONE STANDARD DEVIATION AT REGIONAL STATION 13.

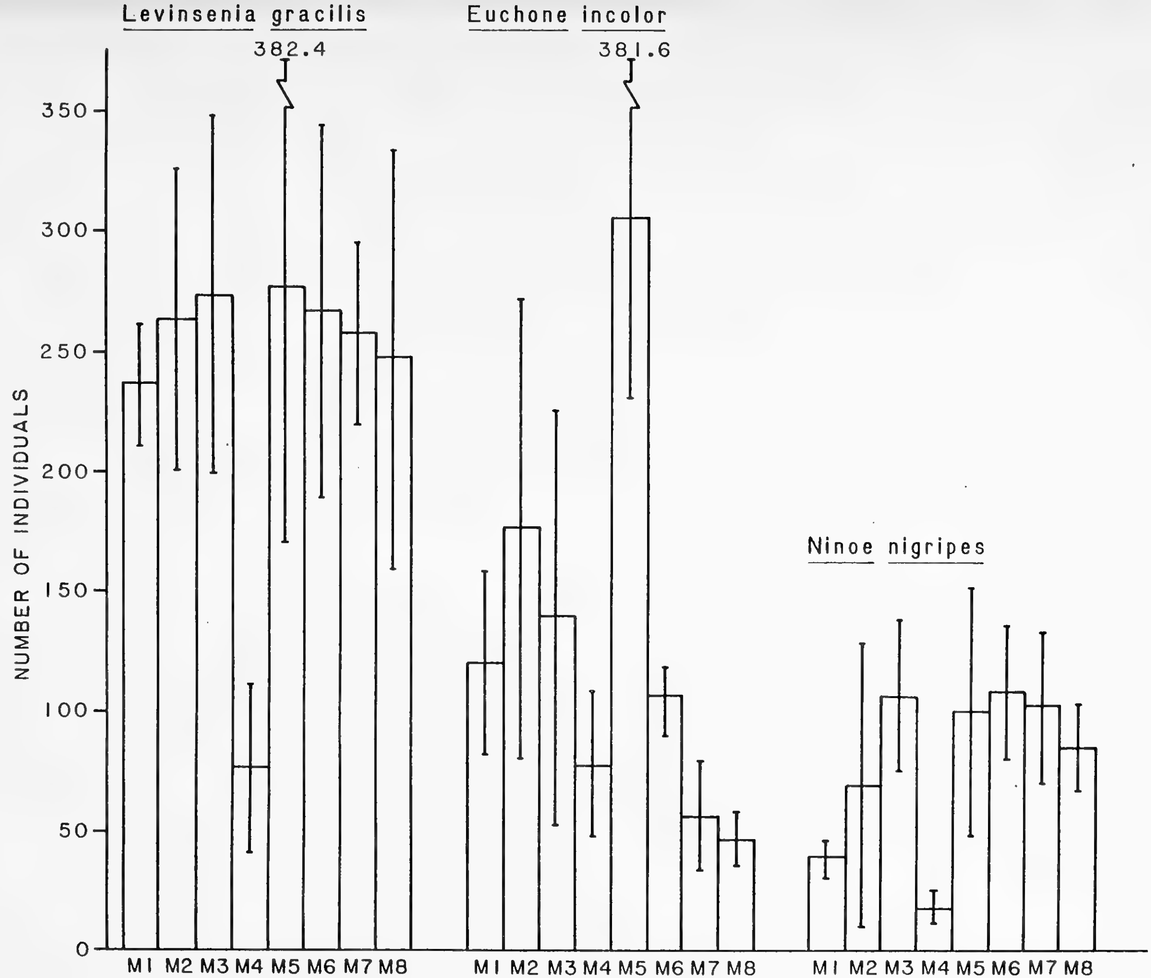


FIGURE 29. AVERAGE NUMBER OF INDIVIDUALS OF THREE POLYCHAETE SPECIES PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT REGIONAL STATION 13.

The population densities of the nine polychaete species presented remained generally stable over the eight sampling seasons. The pattern noted in Year 1 for such species as Notomastus latericeus and Polycirrus sp. A (Figures 21 and 22), for which average densities increased from M1 to M3 and declined in M4, was not repeated in Year 2. The average density of N. latericeus was slightly higher in Year 2 than in Year 1, particularly at Station 16, while the average density of Polycirrus sp. A was generally lower. The dominant polychaete at Stations 16 and 17, Paradoneis n. sp. A, was present in comparable numbers in Year 2 as in Year 1, with slightly (but not significantly) higher numbers in Year 2. The large standard deviations for all sampling periods in Year 1 were also recorded for Year 2, again suggesting that the decline of this species in M2 was not significant. Chone duneri (not plotted) increased significantly in density from Year 1 to Year 2. Such year-to-year fluctuations in individual species account for the clustering of Year 2 data separately from Year 1.

Seasonal densities at Station 13 have been plotted for Ampelisca agassizi, Nucula proxima, the oligochaete Tubificoides n. sp. A (last year referred to as Limnodriloides medioporus), and 11 polychaete species (Figures 25 through 29). Each of these 14 species exhibited a decline in average density in M4, contributing to the overall sharp decline in total density seen at that station for that sampling occasion. For Tubificoides n. sp. A, the decline was not as sharp as for the remaining species, but all species recovered in M5, with average densities comparable to or exceeding those recorded in M3. Again with the exception of Tubificoides n. sp. A and Nucula proxima, densities in M8, the May sampling period comparable to M4, were the lowest of the four Year 2 samples. However, the decline in M8 was not at all as sharp as that seen in M4, and was preceeded by generally declining rather than increasing densities.

5.2.2 Site-Specific Stations

5.2.2.1 Cluster Analysis. Clustering of the site-specific samples mainly shows the distinctness of the westernmost Stations 5-29 and 5-25 where the sediment is considerably finer (Figures 30 and 31). Using NESS, stations south of the central rig site (Stas. 11, 12 and 20) cluster with Station 5-25 for some cruises. The first three cruises (July-February, M1-3) are separated from the remaining cruises. The last group of

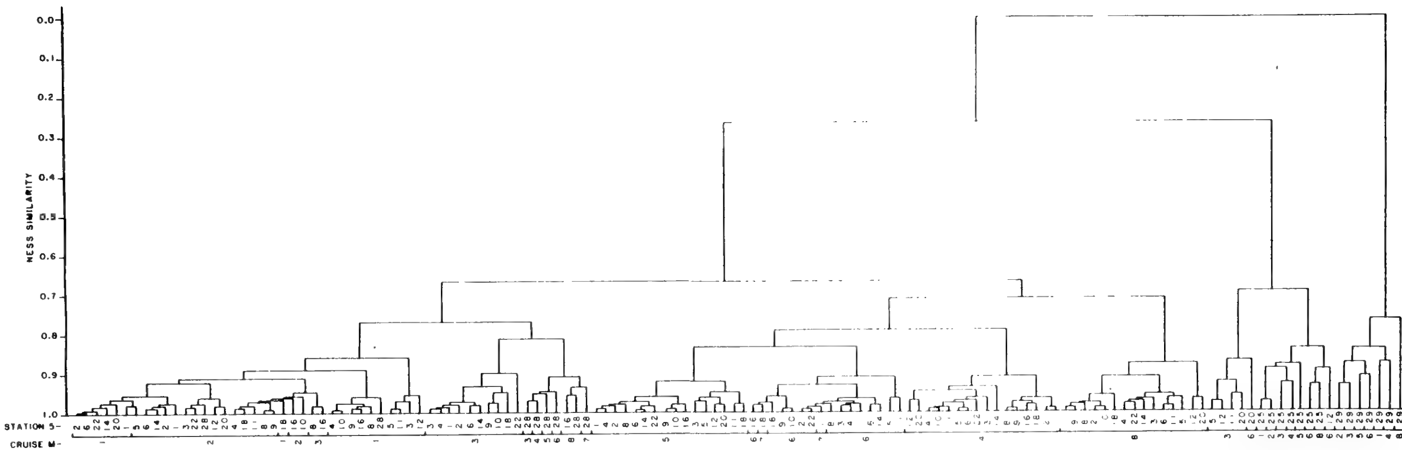


FIGURE 30. SUMMED REPLICATES OF M1 THROUGH M8 SITE-SPECIFIC CLUSTERED BY NESS AT 200 INDIVIDUALS AND FLEXIBLE SORTING

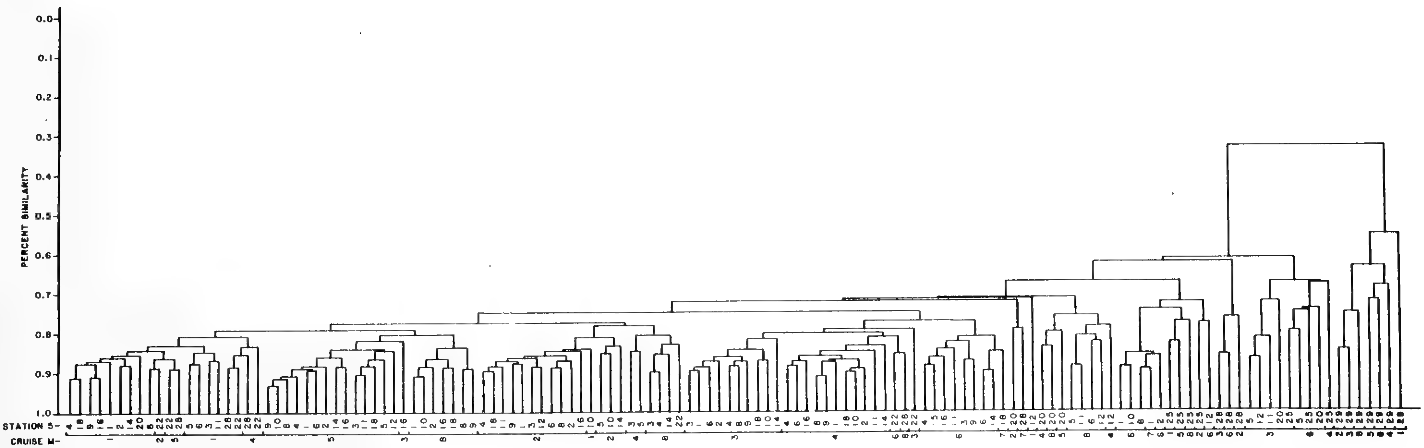


FIGURE 31. SUMMED REPLICATES OF M1 THROUGH M8 SITE-SPECIFIC STATIONS CLUSTERED BY PERCENT SIMILARITY AND GROUP AVERAGE SORTING.

samples, May, 1983 (M8) are somewhat different from the other Year 2 samples, July through February (M5-M7). If the discharge from the rig had an effect on the communities, the central stations would cluster together and the east-west transition would be less of a dominant feature of the results. A careful examination of faunal similarity and sediment (Appendix F) indicated that shifts in fine sand during the winter had an important influence on these communities. Sites south of the rig had a more variable sediment composition than those to the north and east. The second year data confirm that the site-specific array of stations is on a boundary between sediment types. A more recent map of mean surface sediment texture (Butman et al., 1983, Figure 8-10a) on the southern flank of Georges Bank illustrates the boundary to the west and south. The central part of the site-specific array is on a tongue of coarser sand from the north.

Except for the distinct separation of the westernmost Station 5-29, the pattern using percent similarity is less clear. As with the regional station clusters, the 4th root transformation makes it closer to the clusters produced from NESS (Appendix F).

Spearman rank correlation was used to compare community similarity to sediment composition and the most common element in the discharged materials, barium. The barium in the fine fraction and the ratio of total barium from M1 to M5 (Bothner, pers. comm.) were used. The sediment data used were means of percent fine sand and percent silt-clay for all cruises. Two community measures were used: one was NESS similarity at 200 individuals of replicates summed from each station during July, 1982 (M5) with Station 5-28 during July, 1981 (M1) before drilling; the second is the mean of the 36 similarities obtained by measuring similarity between each of the six replicates at a particular station in July, 1982 (M5) with each of the six replicates at the same station during July, 1981 (M1). Station 5-28 was used for comparison since it is the furthest upstream from the drilling activity. In both cases, the correlation with the two measures of barium was not significant. The correlation with silt-clay was also not significant but the correlation with percent fine sand was highly significant using both approaches to measure the similarity of July samples. Either way the probability is .03. Significance levels using the measures of barium are 0.15 or greater. NESS similarities between November samples from subsequent years (M2 vs M6) also gave significant correlations with fine sand but no significant correlations with barium.

5.2.2.2 Population Patterns of Selected Species. The average densities of one amphipod and 21 polychaete species at Station 5-1 for M1 through M8 are plotted in Figures 32 through 36. In Year 2, most species were at or above the average densities reported in Year 1. Some species, such as the amphipod Unciola inermis (Figure 32) or the syllids Parapionosyllis longicirrata (Figure 35), Sphaerosyllis cf. brevifrons and Exogone verugera (Figure 36) showed wide fluctuations in density over time while others such as Aricidea cerruti, Notomastus latericeus (Figure 33) and Streptosyllis arenae (Figure 35) exhibited very stable population levels. There does not appear to be any detectable influence of drilling operations on the population densities of any of the species plotted.

Figures 37 through 44 are computer generated maps of average densities of four dominant species at all of the primary site-specific stations. These maps also include a plot of the percentages of fine sand and very fine sand at each station for each cruise. The percentage of both of these sediment size classes were higher in Year 2 than in Year 1.

The overall densities of Unciola inermis at many stations sampled in Year 2 were generally similar to the densities recorded in Year 1. Both spatial and seasonal trends were similar between years. Densities at most stations were highest in July (M5) and May (M8), and lowest in November (M6) and February (M7). A minor exception is that during Year 2, the density at Station 5-28 did not increase during May (M8) from the low winter density as it did during Year 1. The seasonal trend appears to be representative of a natural population fluctuation because the largest percentage of gravid females was found in February (M7) and the largest percentage of juveniles was found in May (M8). The peak density of juveniles (60 percent) coincides with the peak population density. The seasonal trends were similar in Year 1 when drilling occurred, and Year 2, when no drilling occurred.

The overall densities of Erichthonius rubricornis at many stations sampled in Year 2 were generally higher than the densities recorded in Year 1. Spatial trends were similar to those seen in Year 1, but seasonal trends appeared somewhat dissimilar. Drilling began in December, just after Cruise M2. In Year 1, there was a population decline from July (M1) through February (M3) at three stations close to the drilling rig (Stations 5-1, 5-2, 5-8). In Year 2, there were slight increases in November at most stations, both near and far from the former drilling site. In Year 2, only three stations

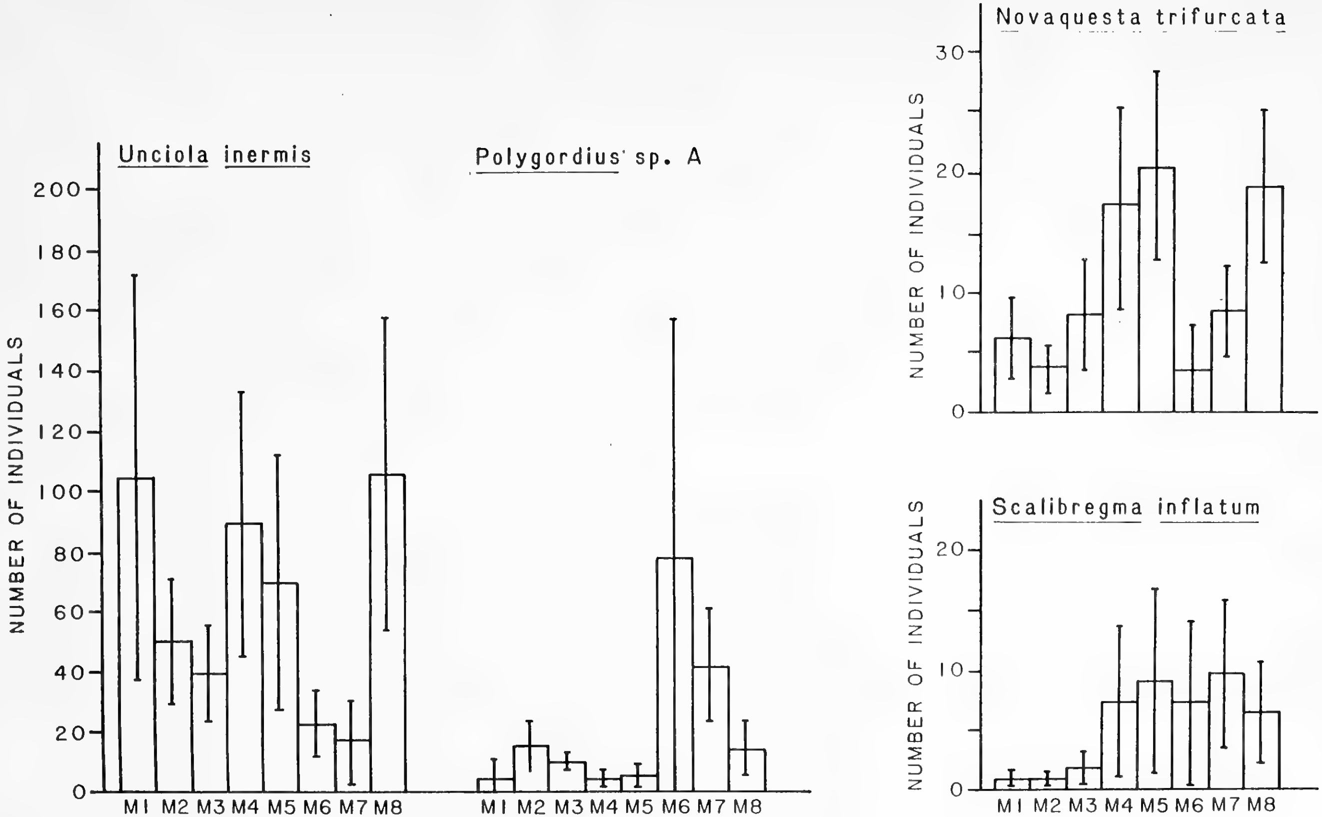


FIGURE 32. AVERAGE NUMBER OF INDIVIDUALS OF ONE AMPHIPOD SPECIES AND THREE POLYCHAETE SPECIES PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT STATION 5-1.

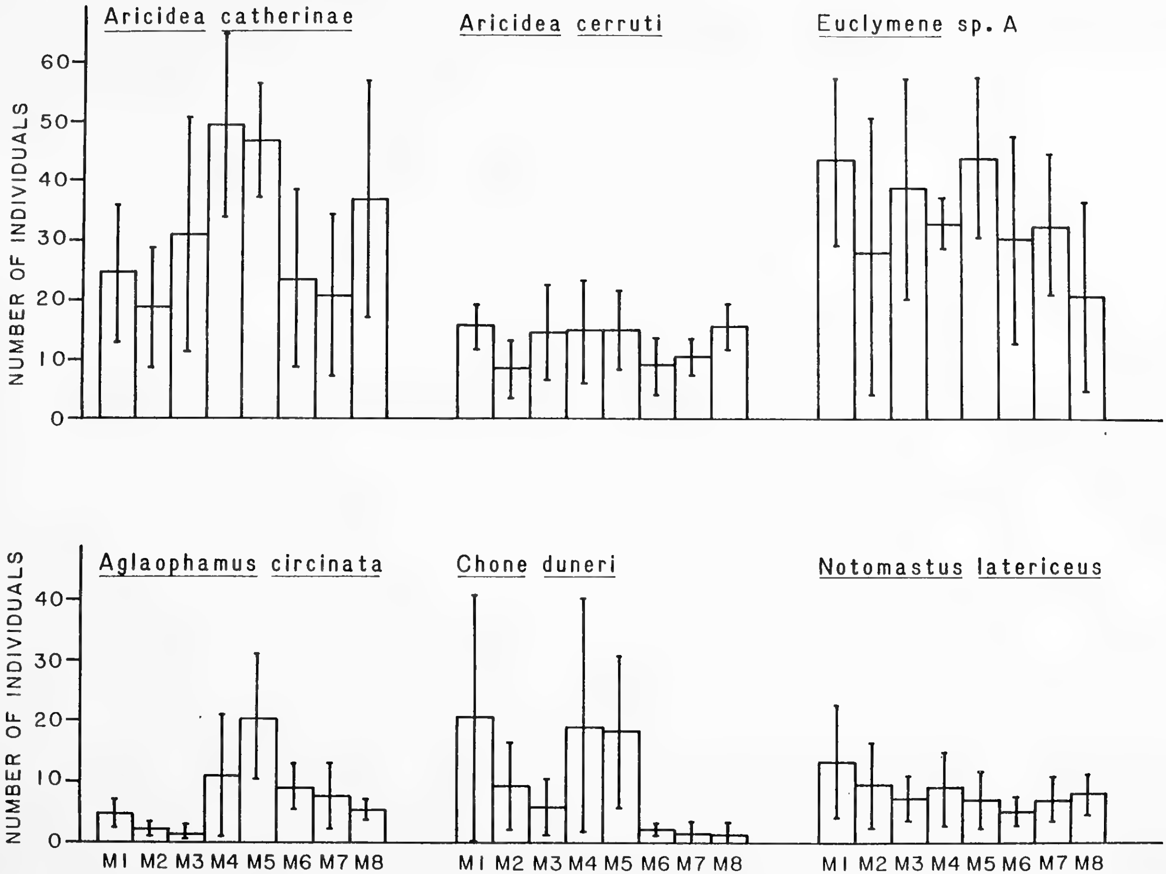


FIGURE 33. AVERAGE NUMBER OF INDIVIDUALS OF SIX POLYCHAETE SPECIES PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT STATION 5-1.

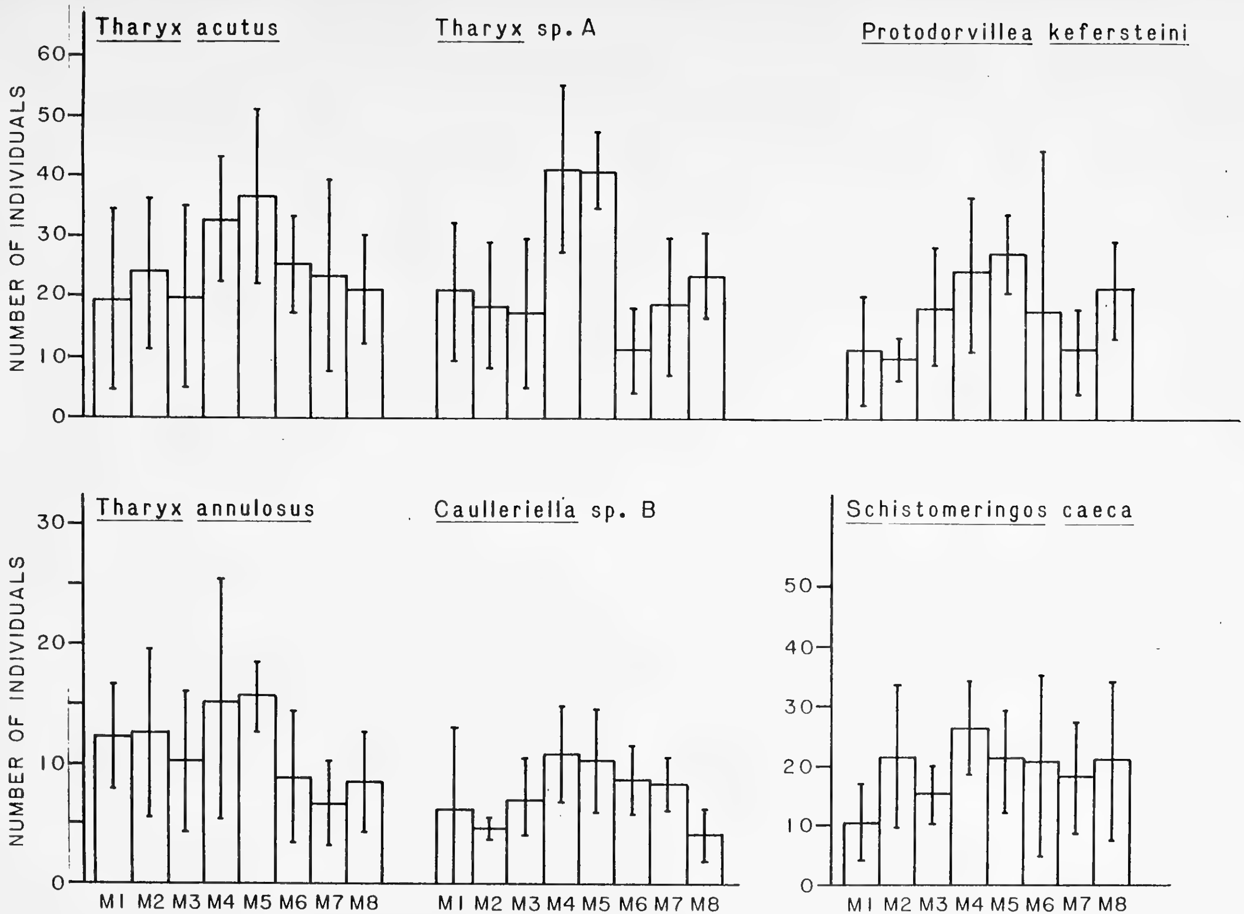


FIGURE 34. AVERAGE NUMBER OF INDIVIDUALS OF SIX POLYCHAETE SPECIES PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT STATION 5-1.

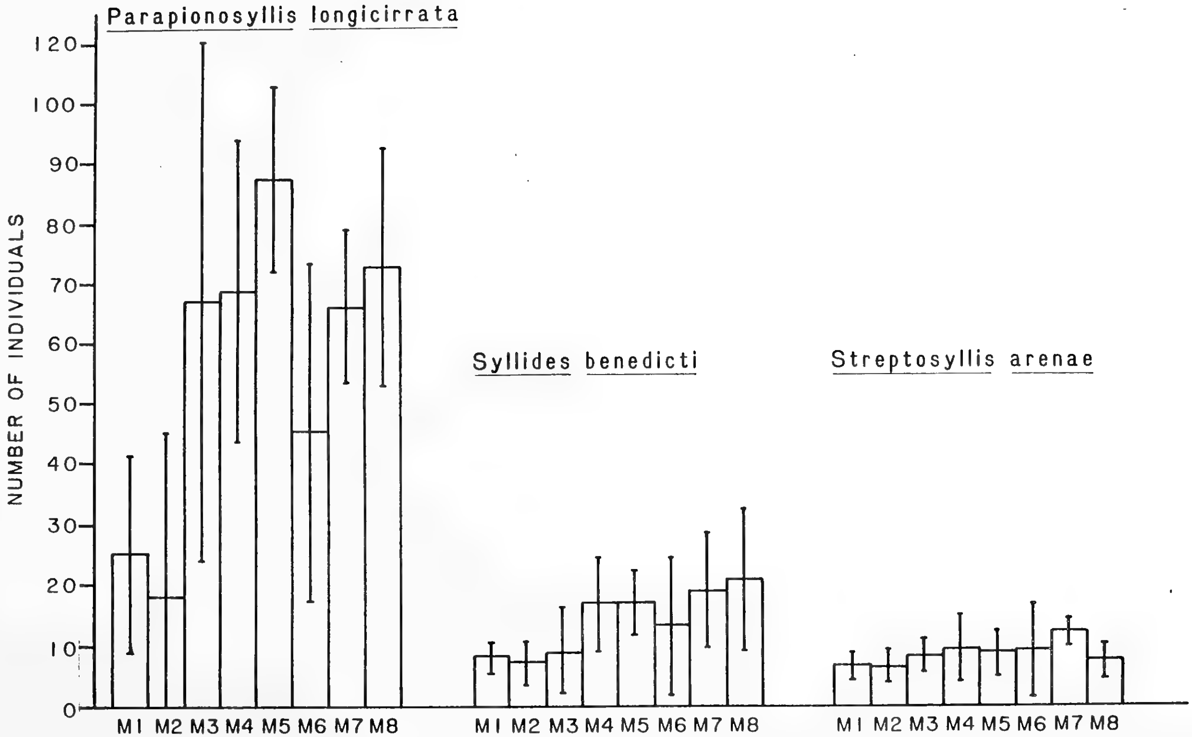


FIGURE 35. AVERAGE NUMBER OF INDIVIDUALS OF THREE POLYCHAETE SPECIES PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT STATION 5-1.

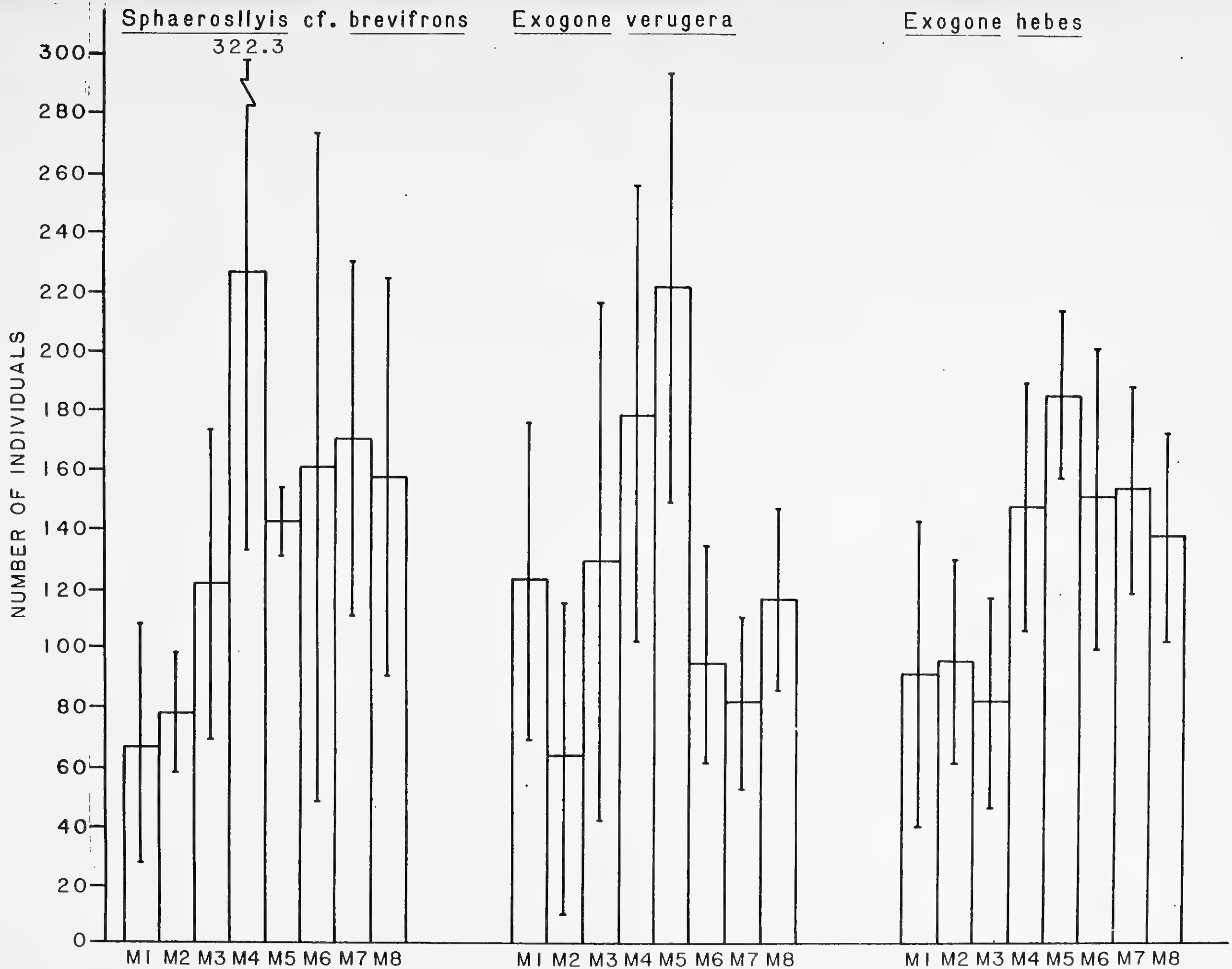


FIGURE 36. AVERAGE NUMBER OF INDIVIDUALS OF THREE POLYCHAETE SPECIES PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT STATION 5-1.

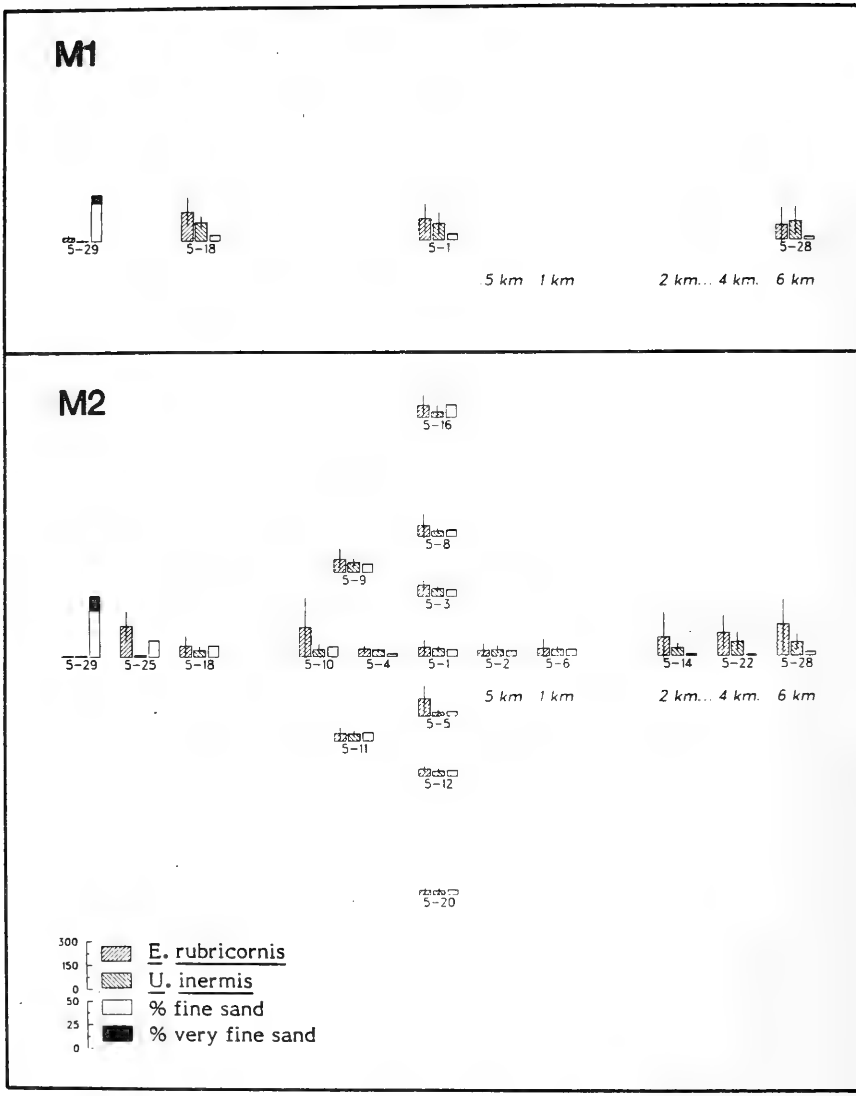


FIGURE 37. DENSITIES OF Erichthonius rubricornis AND Unciola inermis IN RELATION TO SEDIMENT CHARACTERISTICS AT SITE-SPECIFIC STATION ARRAY IN CRUISES M1 AND M2.

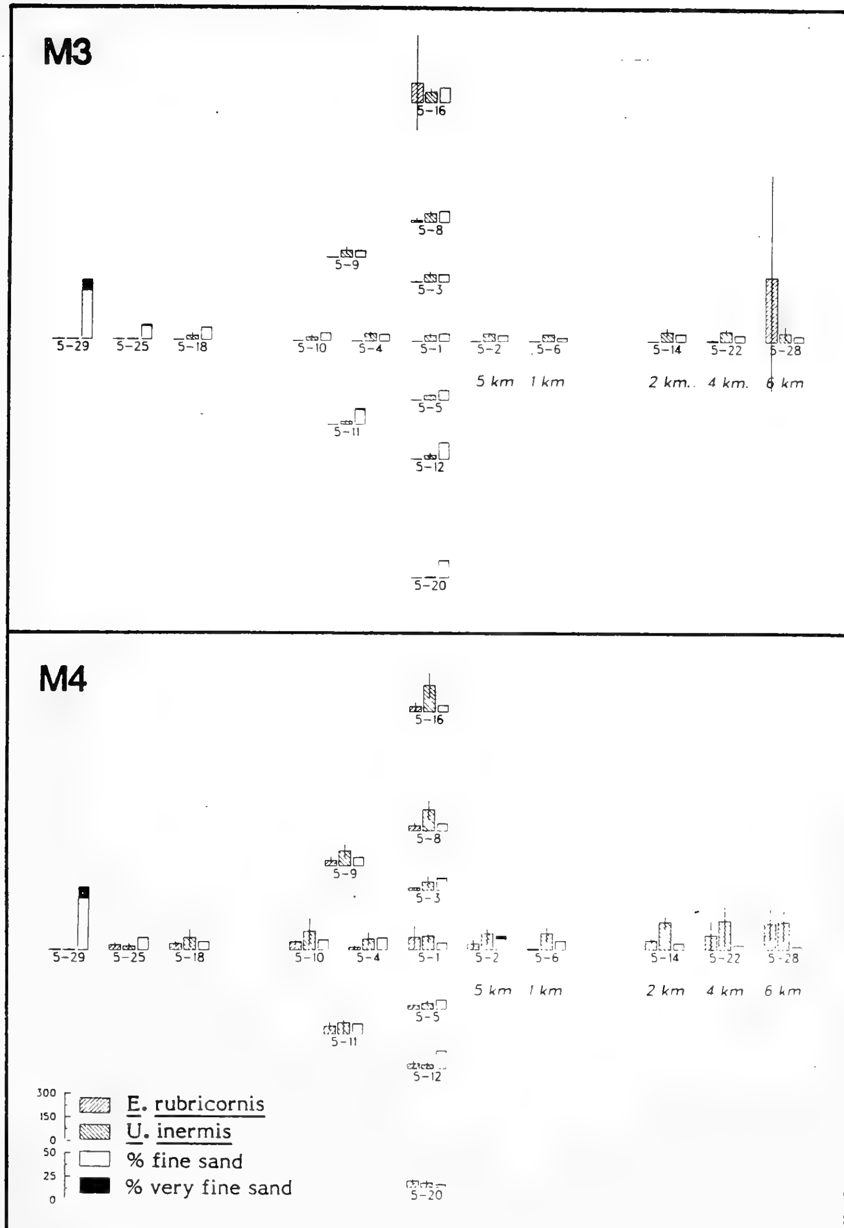


FIGURE 38. DENSITIES OF Erichthonius rubricornis AND Unciola inermis IN RELATION TO SEDIMENT CHARACTERISTICS AT SITE-SPECIFIC STATION ARRAY IN CRUISES M3 AND M4.

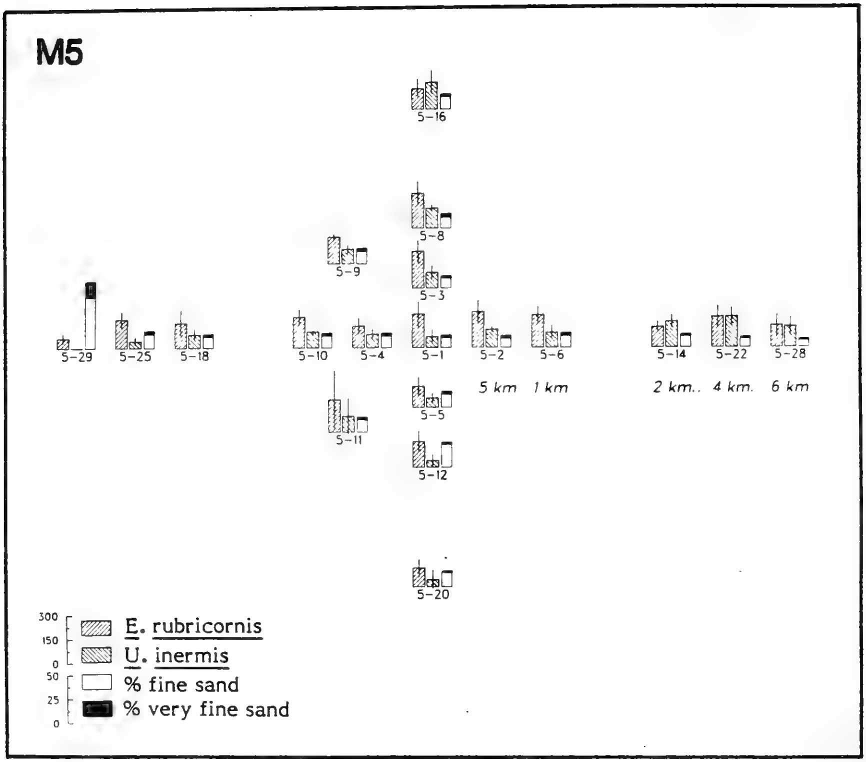


FIGURE 39. DENSITIES OF Erichthonius rubricornis AND Unciola inermis IN RELATION TO SEDIMENT CHARACTERISTICS AT SITE-SPECIFIC STATION ARRAY IN CRUISE M5.

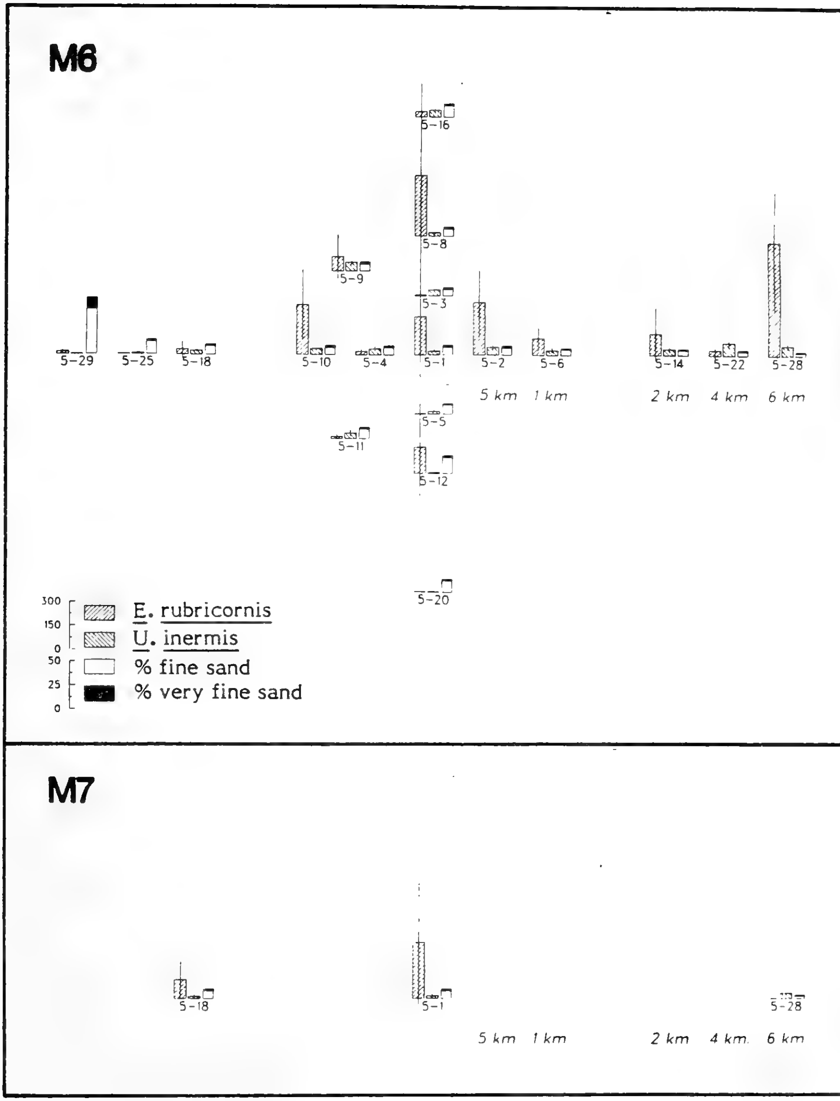


FIGURE 40. DENSITIES OF Erichthonius rubricornis AND Unciola inermis IN RELATION TO SEDIMENT CHARACTERISTICS AT SITE-SPECIFIC ARRAY IN CRUISES M6 AND M7.

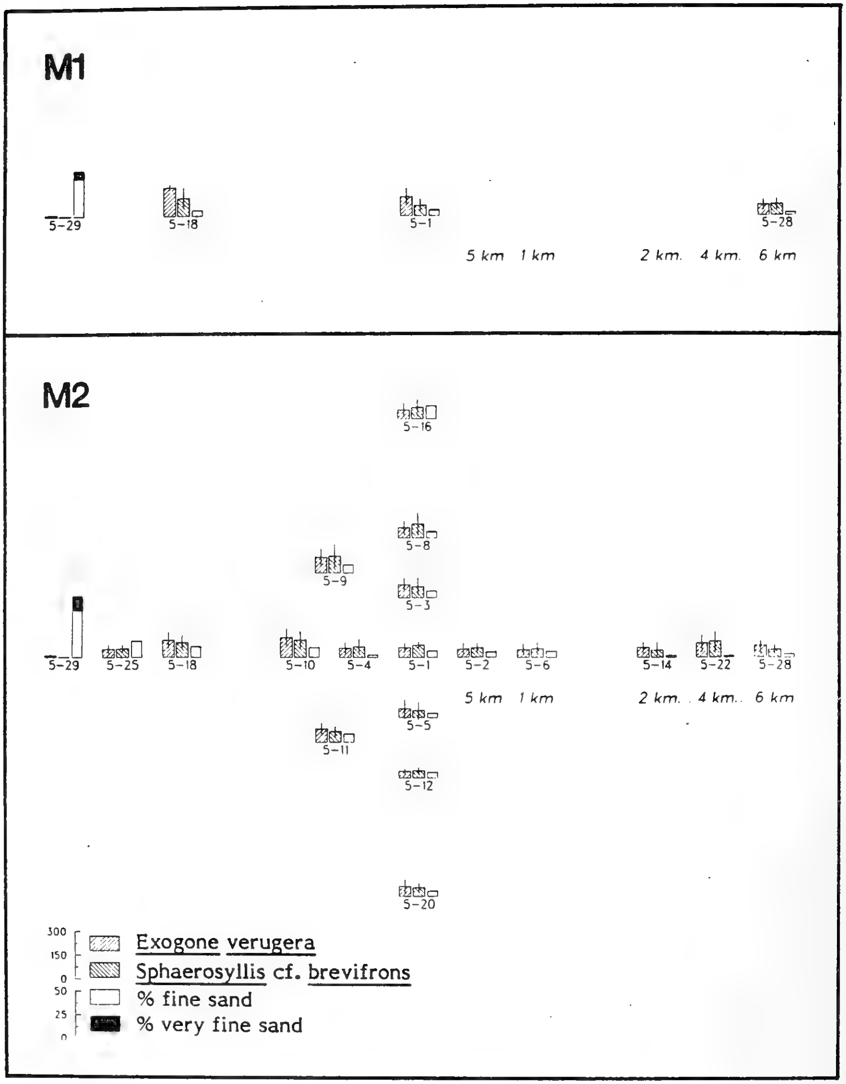


FIGURE 41. DENSITIES OF Exogone verugera AND Sphaerosyllis cf. brevifrons IN RELATION TO SEDIMENT CHARACTERISTICS AT SITE-SPECIFIC STATION ARRAY IN CRUISES M1 and M2.

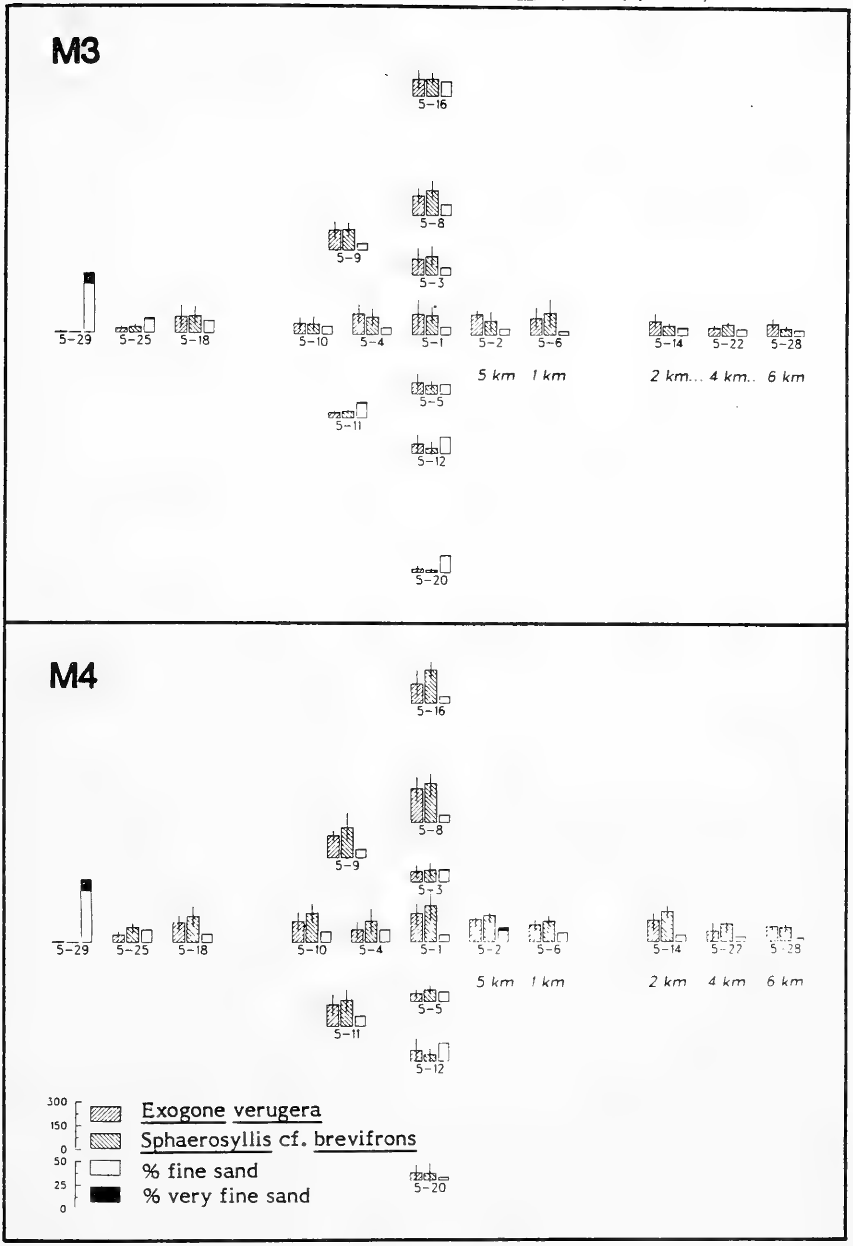


FIGURE 42. DENSITIES OF Exogone verugera AND Sphaerosyllis cf. brevifrons IN RELATION TO ARRAY IN CRUISES M3 AND M4.

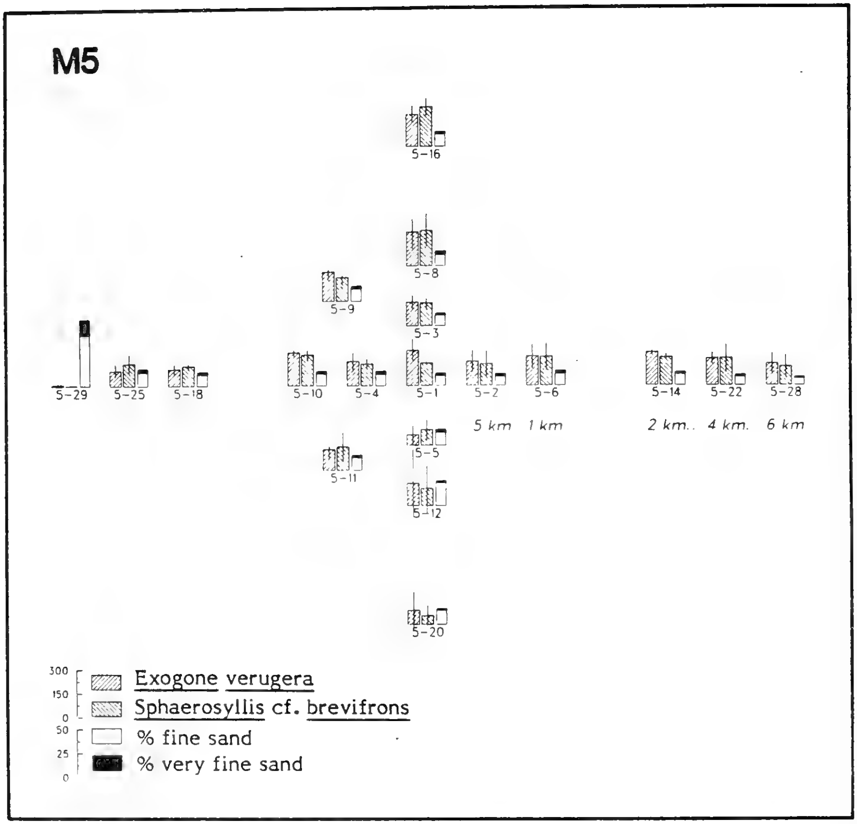


FIGURE 43. DENSITIES OF Exogone verugera AND Sphaerosyllis cf. brevifrons IN RELATION TO SEDIMENT CHARACTERISTICS AT SITE-SPECIFIC STATION ARRAY IN CRUISE M5.

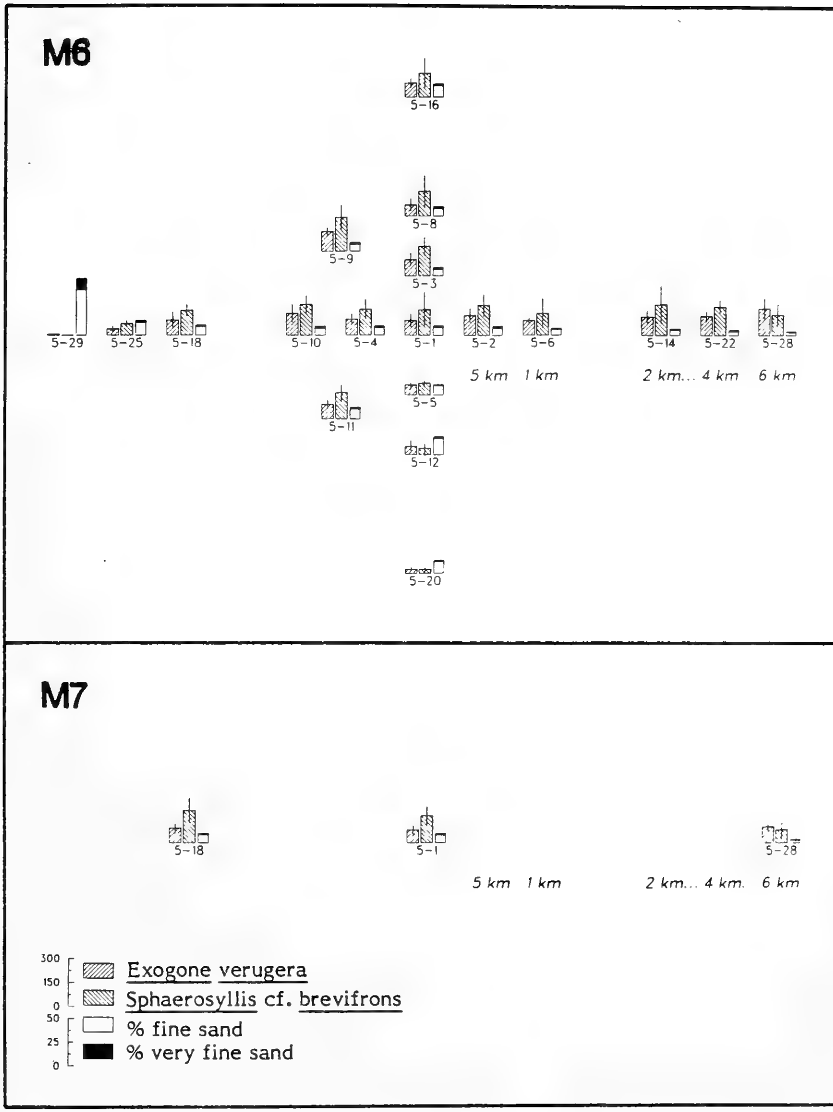


FIGURE 44. DENSITIES OF Exogone verugera AND Sphaerosyllis cf. brevifrons IN RELATION TO SEDIMENT CHARACTERISTICS AT SITE-SPECIFIC STATION ARRAY IN CRUISES M6 AND M7.

were sampled during February, and Station 5-1 showed a population increase, rather than a decrease as during Year 1.

Reproductive individuals of E. rubricornis (gravid, brooding, or females with setose oostegites) were found in all Year 2 samples, comprising from 3 to 10 percent of the population. Juveniles were found year-round and ranged from 10 percent of the population in July (M5) to 34 percent in May (M8). At most stations the highest density of individuals was recorded in November (M6) when 31 percent of the population was juvenile. Density was considerably lower in M8, when the highest percentage (34 percent) of the specimens were juveniles. Recruitment of juveniles into the population may not be important in explaining spatial and seasonal density differences, as it was with Ampelisca agassizi.

Erichthonius rubricornis is an epifaunal suspension feeder which has a positive correlation with coarse sediments and gravel (Battelle and W.H.O.I., 1983). Because of its patchy distribution within the six replicate samples taken at a station, the standard deviation was relatively high when compared to Unciola inermis and Ampelisca agassizi. The high standard deviations plus the lack of February samples from Year 2 make it difficult to discern whether apparent seasonal differences between Year 1 and Year 2 are real or an artifact. Data from Year 3 will help determine a trend.

5.3 Historic Infaunal Sample Task

Station A (40°51.0'N, 67°24.4'W) is approximately 20 miles northeast of Station 5-1 and 24 miles west-southwest of Station 2 at a depth of 85 m. Station A was the site of a long-term series of bottom moorings set up to study currents and sediment resuspension (Butman and Moody, 1983).

The same four species were most common at Station A on all seven sampling dates regardless of season: Ampelisca agassizi, Polygordius sp. A, Erichthonius rubricornis and Exogone hebes (Table 11). The dominance of these species indicates that Station A is more similar to the 104 m depth monitoring Station 6 than to Stations 5 and 2 along the 80 m contour (Table 6). Density of species and individuals (Figures 45-48) were constant throughout the sampling period and did not fluctuate with the drastic fluctuations recorded in bottom conditions during winter storms (Butman and Moody,

TABLE 11. DOMINANT SPECIES AT STATION A FOR EACH SAMPLING OCCASION.

May, 1980

Ampelisca agassizi
Exogone hebes
Erichthonius rubricornis
Polygordius sp.
Arctica islandica
Photis pollex
Harpinia propinqua
Aglaophamus circinata
Chone duneri
Tubificoides n. sp. A
Clymenella torquata

December, 1980

Ampelisca agassizi
Polygordius sp.
Exogone hebes
Erichthonius rubricornis
Harpinia propinqua
Arctica islandica
Tubificoides n. sp. A
Clymenella torquata
Photis pollex
Eudorella pusilla

January, 1981

Ampelisca agassizi
Polygordius sp.
Exogone hebes
Erichthonius rubricornis
Arctica islandica
Tubificoides n. sp. A
Harpinia propinqua
Notomastus latericeus
Photis pollex
Cirrophorus furcatus

April, 1981

Ampelisca agassizi
Polygordius sp.
Exogone hebes
Erichthonius rubricornis
Tubificoides n. sp. A
Harpinia propinqua
Notomastus latericeus
Aglaophamus circinata
Eudorella pusilla
Arctica islandica

Sept-Oct, 1981

Ampelisca agassizi
Polygordius sp.
Exogone hebes
Erichthonius rubricornis
Aglaophamus circinata
Harpinia propinqua
Notomastus latericeus
Tubificoides n. sp. A
Eudorella pusilla
Chone duneri

Jan-Feb, 1982

Ampelisca agassizi
Erichthonius rubricornis
Polygordius sp.
Exogone hebes
Notomastus latericeus
Harpinia propinqua
Tubificoides n. sp. A
Eudorella pusilla
Arctica islandica
Aglaophamus circinata

July, 1982

Ampelisca agassizi
Erichthonius rubricornis
Exogone hebes
Polygordius sp.
Harpinia propinqua
Aglaophamus circinata
Notomastus latericeus
Eudorella pusilla
Tubificoides n. sp. A
Arctica islandica

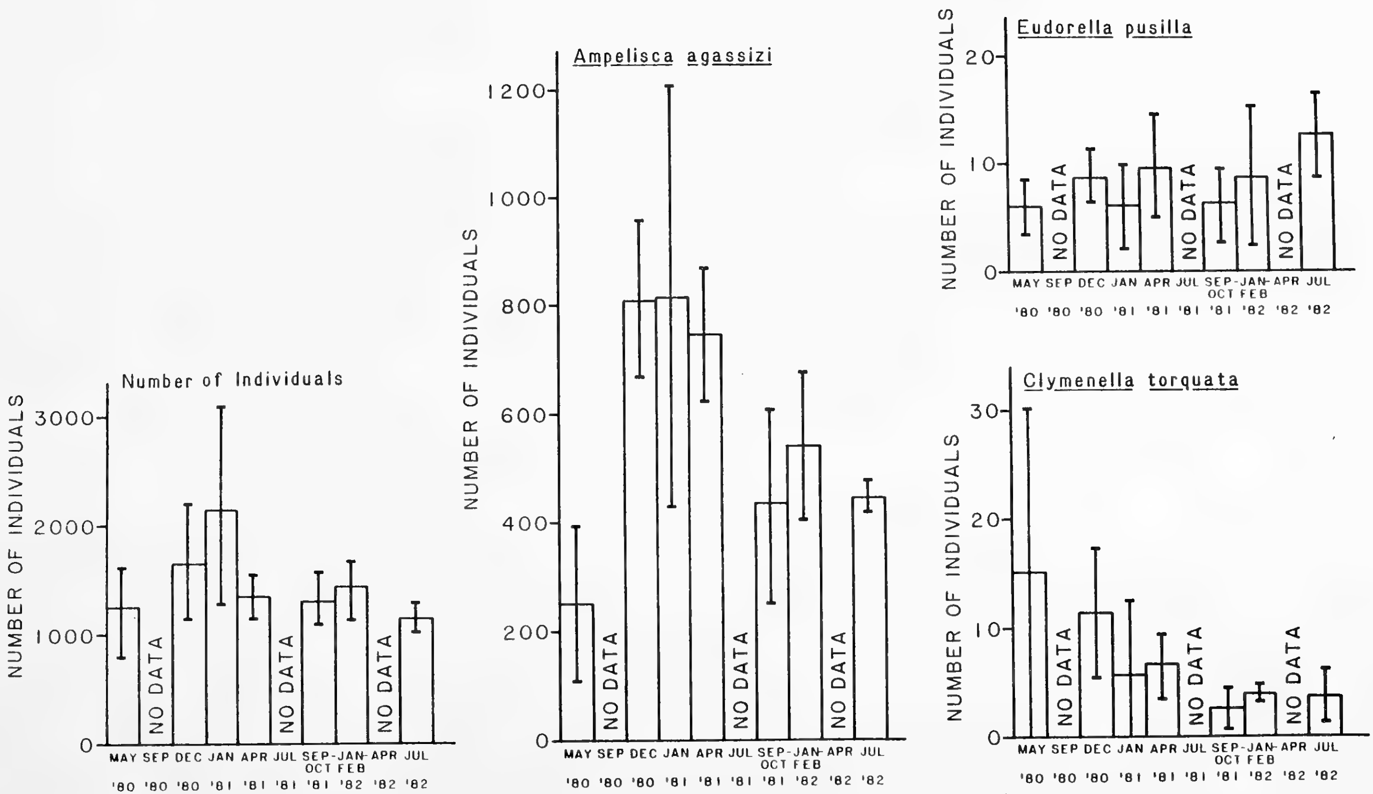


FIGURE 45. AVERAGE NUMBER OF INDIVIDUALS PER 0.04 $m^2 \pm$ ONE STANDARD DEVIATION, AND AVERAGE NUMBER OF INDIVIDUALS OF Ampelisca agassizi, Eudorella pusilla and Clymenella torquata PER 0.04 $m^2 \pm$ ONE STANDARD DEVIATION AT STATION A.

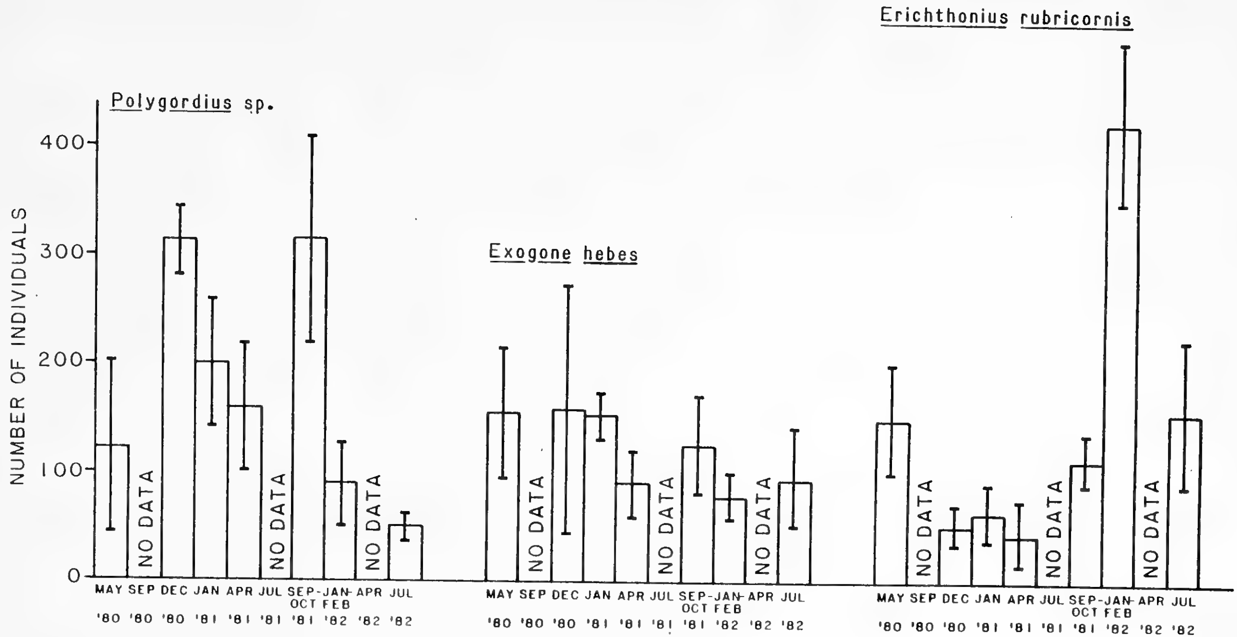


FIGURE 46. AVERAGE NUMBER OF INDIVIDUALS OF TWO POLYCHAETE SPECIES AND ONE AMPHIPOD SPECIES PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT STATION A.

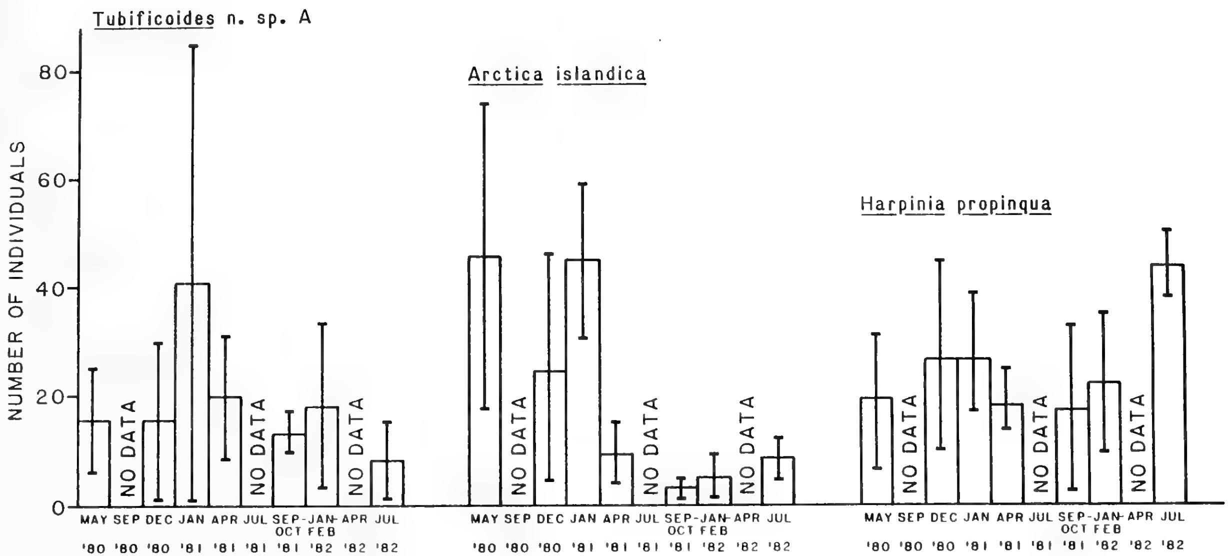


FIGURE 47. AVERAGE NUMBER OF INDIVIDUALS OF ONE OLIGOCHAETE SPECIES, ONE MOLLUSC SPECIES AND ONE AMPHIPOD SPECIES PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT STATION A.

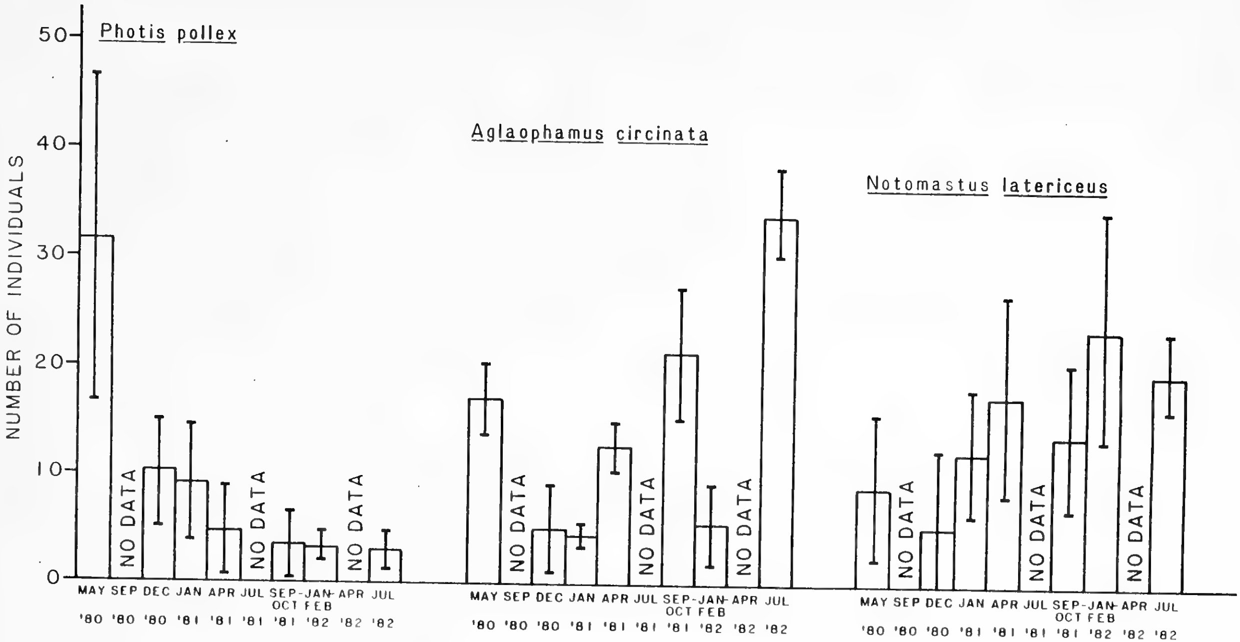


FIGURE 48. AVERAGE NUMBER OF INDIVIDUALS OF ONE AMPHIPOD SPECIES AND TWO POLYCHAETE SPECIES PER 0.04 m^2 $\pm$ ONE STANDARD DEVIATION AT STATION A.

1983). Erichthonius rubricornis and Notomastus latericeus were maximally abundant during September-October, 1981 and Photis pollex and Clymenella torquata were most abundant at the first sampling date in May, 1980. An examination of the intensity of winter storms in the two years may suggest an explanation for the difference between years.

5.4 Life History of Dominant Species

Species for life history analyses were selected from among several of the dominant polychaetes at Stations 5-1 (Site-Specific), 13 (Mud Patch) and 16, 17, and 18 (Block 410) and from three dominant amphipods at Station 5-1 and 13. For most species, sufficient numbers of specimens were available to establish the timing of reproduction and recruitment. Some valid observations have been made on the presence of gametes, egg diameters and sex ratios. From these observations, estimates of the time of spawnings could be extrapolated. In some cases where data were insufficient to draw firm conclusions, alternate plans have been made to develop a more adequate data base during the next year.

Specimens examined to date include only those from Cruises M1 (July, 1981), M2 (November, 1981), M3 (February, 1982) and M4 (May, 1982).

5.4.1 Polychaetes at Station 5-1

Two very different groups of polychaetes were studied from Station 5-1, including 5 species of Syllidae and 3 species of Cirratulidae.

> **Exogone hebes** - Exogone hebes is viviparous and carried young inside the body cavity in February and May (M3, M4). Oocytes were present in July and November (M1, M2) with ripe males occurring in July (M1). Fertilization probably takes place in the fall with embryology and development occurring during the winter. Spawning and recruitment occur in the spring. The highest number of small sizes (11-15 setigers) occurred in July (M1), suggesting a spring recruitment (Figure 49). The settling size class of M1 may be followed through M4. It is not clear whether an older size class persists or if there is some differential growth of the recruiting cohort.

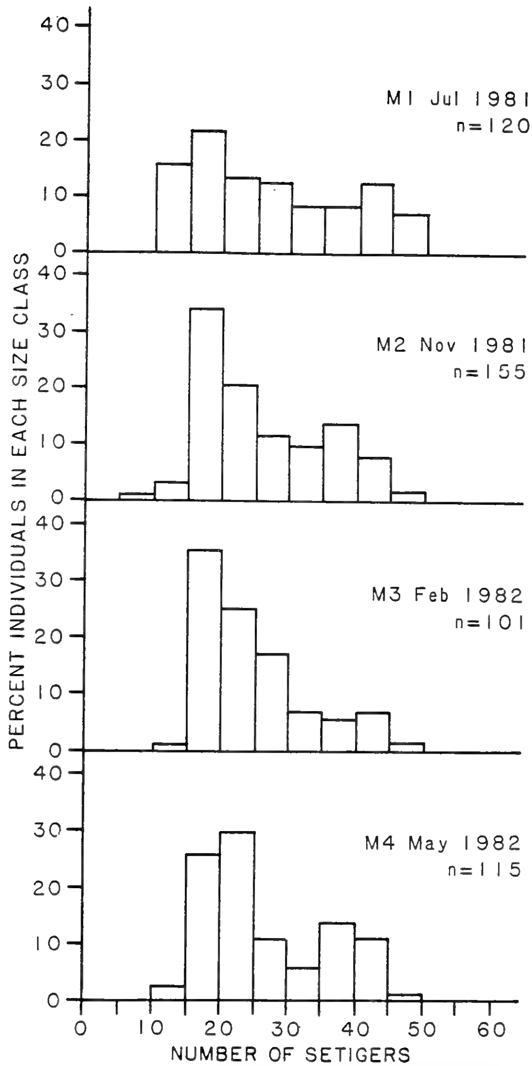


FIGURE 49. SIZE CLASS FREQUENCY OF Exogone hebes AT STATION 5-1.

These results are in general agreement with those recently reported from the E. hebes population on the Grand Banks, off Newfoundland by Pocklington and Hutcheson (1983). These authors reported a spring spawning maximum as in the present study, but noted year-round presence of incubating females.

Exogone verugera - The reproductive pattern of E. verugera was clearly defined at Station 5-1. Internal oocytes were present in 36 percent of the specimens (females) in July (M1), while 52 percent were males. In November (M2), 40 percent of the population were females either with internal oocytes or carrying external eggs. In February (M3), young were observed being carried by the females. In May (M4), internal oocytes were again observed (14 percent), but external eggs and/or larvae were not present. These data and observations of the smallest size classes in February and May (M3, M4) clearly indicate a winter spawning and recruitment (Figure 50).

Parapionosyllis longicirrata - This species exhibits its major recruitment in July (M1). Reproductive events including the appearance of mature eggs and natatory setae appear in May (M4), although mature eggs are abundant in July as well (Figure 51).

Sphaerosyllis cf. brevifrons - The reproductive events for S. cf. brevifrons were very clear at Station 5-1. Females with eggs attached to the body comprised 35 percent of the population in July (M1), and 41 percent in November (M2). Also in the M2 sample were numerous females with attached larvae. Eggs and larvae were not observed in the winter (M3) and spring (M4) collections, although 37 percent and 32 percent of the worms respectively were observed to have internal oocytes. Sperm were observed in 49 percent of the specimens in M1, 0 percent in M2, 0.08 percent in M3 and 12 percent in M4. The smallest size classes were 11-16 and 16-20 setigers (Figure 52) and these were most prevalent in M2 (66.4 percent). Thus, S. cf. brevifrons reproduces most actively in the spring and summer and recruits most actively in the fall months.

Streptosyllis arenae - At Station 5, S. arenae appeared to reproduce in the spring and recruit in summer. The smallest juveniles were present in July (M1), but none of that particular size range were identified in the three later collections. Two distinct size groups were apparent in the February (M3) collection, the first of which corresponds to the settling forms in M1 (Figure 53).

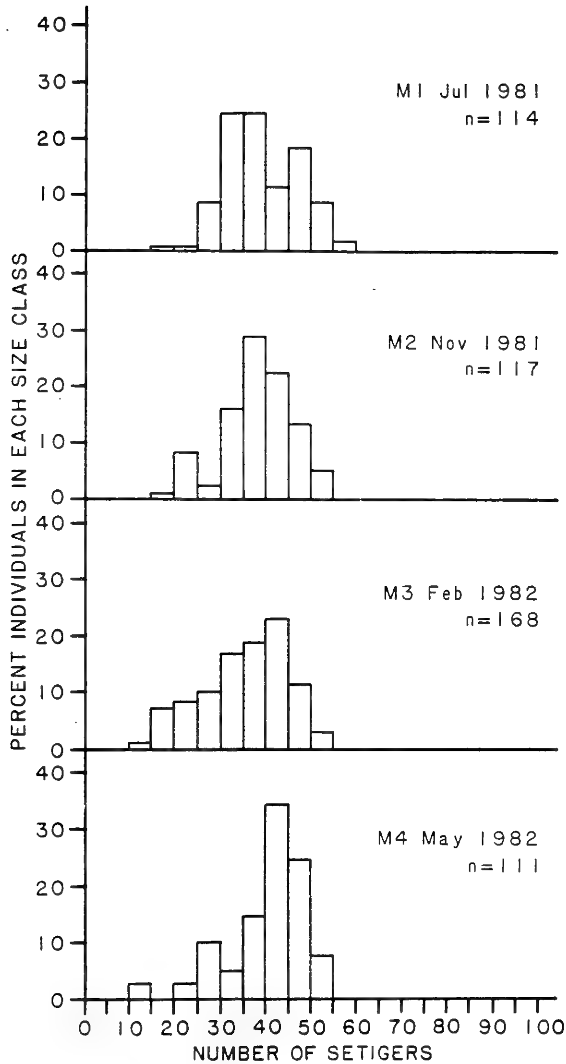


FIGURE 50. SIZE CLASS FREQUENCY OF Exogone verugera AT STATION 5-1.

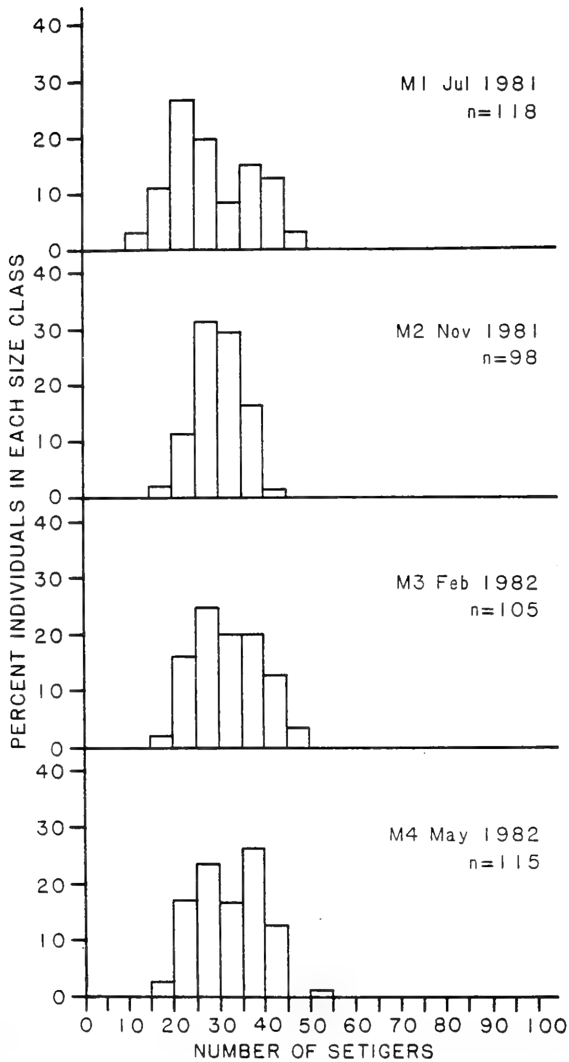


FIGURE 51. SIZE CLASS FREQUENCY OF Parapionosyllis longicirrata AT STATION 5-1.

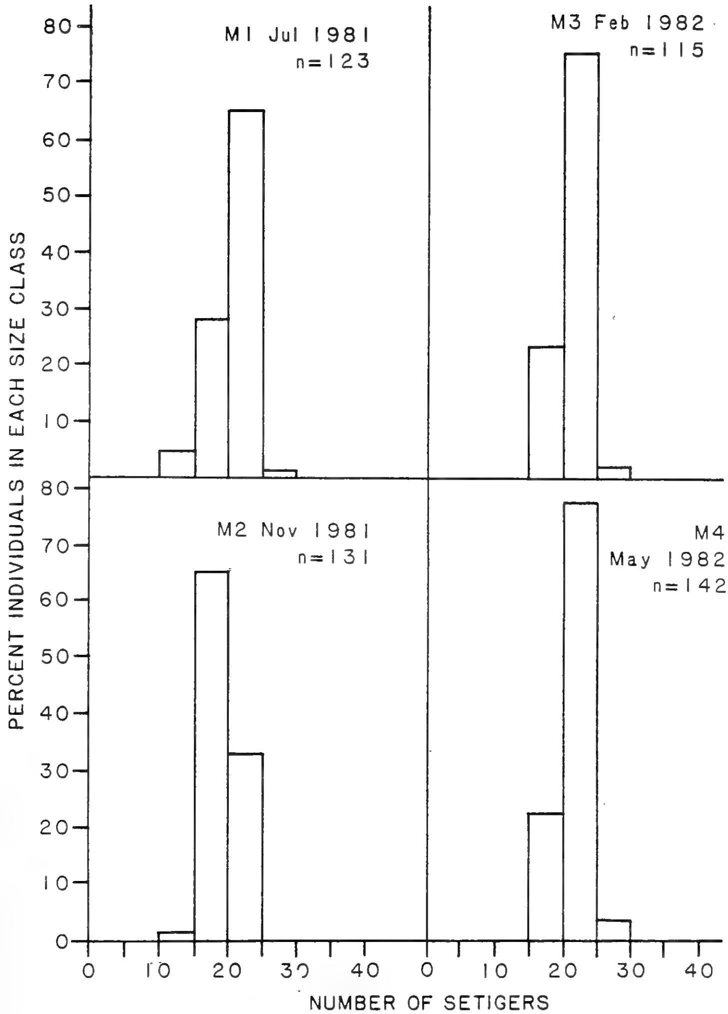


FIGURE 52. SIZE CLASS FREQUENCY OF Sphaerosyllis cf. brevifrons AT STATION 5-1.

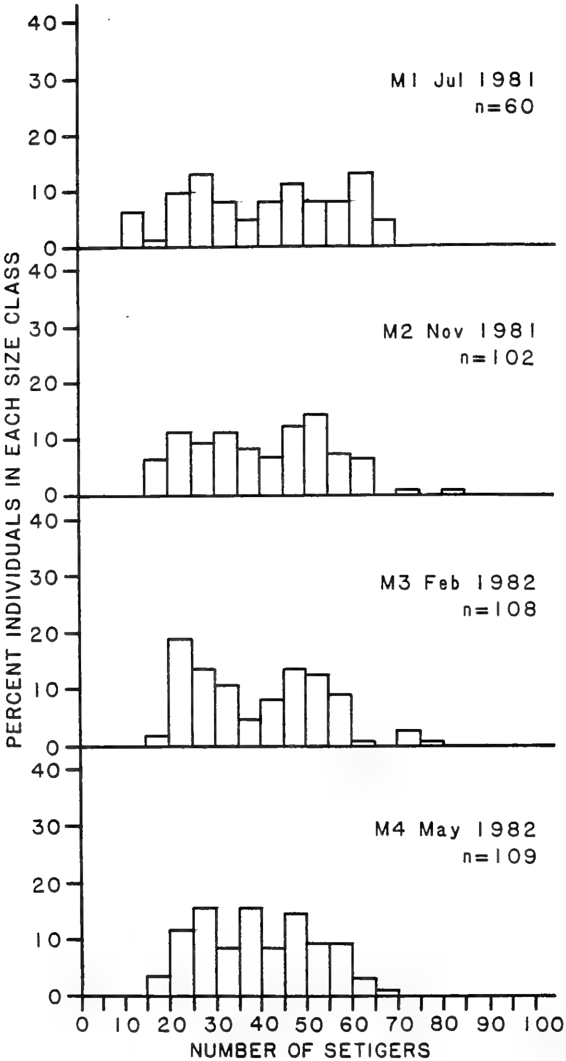


FIGURE 53. SIZE CLASS FREQUENCY OF Streptosyllis arenae AT STATION 5-1.

Syllides benedicti - There is good evidence for recruitment in the summer collection (M1), with 32.7 percent of the specimens less than 25 setigers long (Figure 54). This species appeared to reproduce in spring and summer, although oocytes were observed in some specimens year-round.

Tharyx annulosus - A spring/summer recruitment is suggested at Station 5-1. The highest percentages of juveniles occured in the July (M1) collection. The largest size classes included those worms of 60 setigers or larger which were present in substantial numbers in all collections (Figure 55). Eggs were present in 22 percent of females in M1, 13 percent (M2), 8 percent (M3), and 11 percent (M4).

Tharyx sp. A - Tharyx sp. A is a dominant species at Station 5-1. Results of the age/size measurements were inconclusive in determining the pattern of reproduction for this species. Size classes were scattered over the histogram and no distinct pattern emerges (Figure 56). Reproductive data document that 59 percent of the specimens had natatory setae in November (M2), while mature eggs were present in July (M1 - 11 percent). This suggests that reproduction may have occurred in summer or fall.

Tharyx acutus - Age/size data for Tharyx acutus indicate a recruitment in July (M1). This settling class could be followed over the next three collection periods through May (M4) (Figure 57). This group was clearly separated from the previous year class.

These data strongly suggest that this species has a two-year life cycle and probably spawns twice. Eggs were present only in the July and May collections. Eggs occurred in animals of 50 setigers or larger, suggesting that both the first and second year classes spawn.

Data from Station 13 are fragmentary for this species, but the same pattern of reproduction is suggested (Figure 58).

5.4.2 Polychaetes at Station 13

For Station 13, one cirratulid, Tharyx acutus, has already been mentioned (see Station 5-1 above). Cossura longocirrata and three species of Paraonidae (Aricidea catherinae, A. suecica, and Levinsenia gracilis) were studied in detail. Data for another

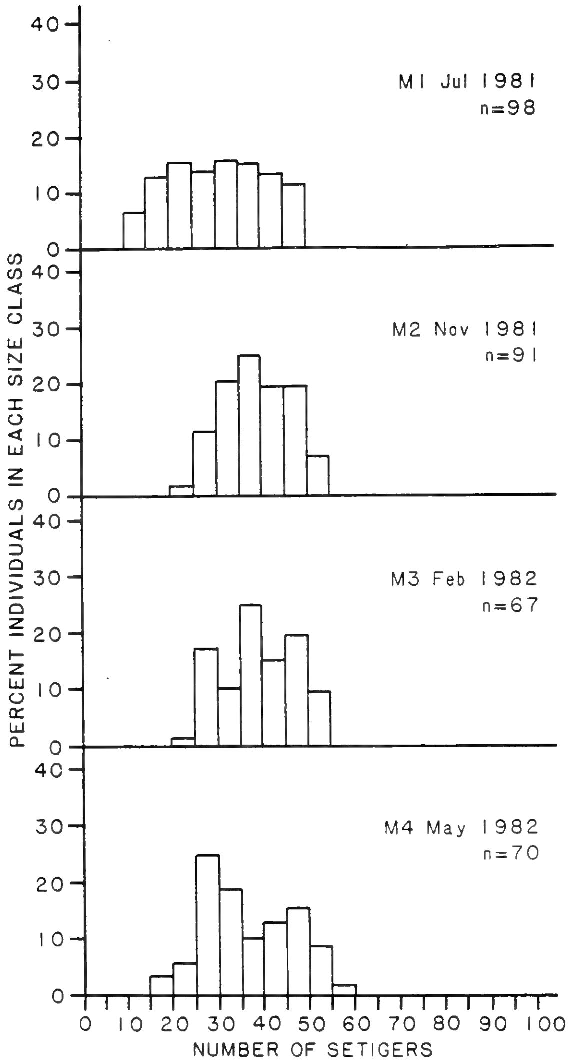


FIGURE 54. SIZE CLASS FREQUENCY OF Syllides benedicti AT STATION 5-1.

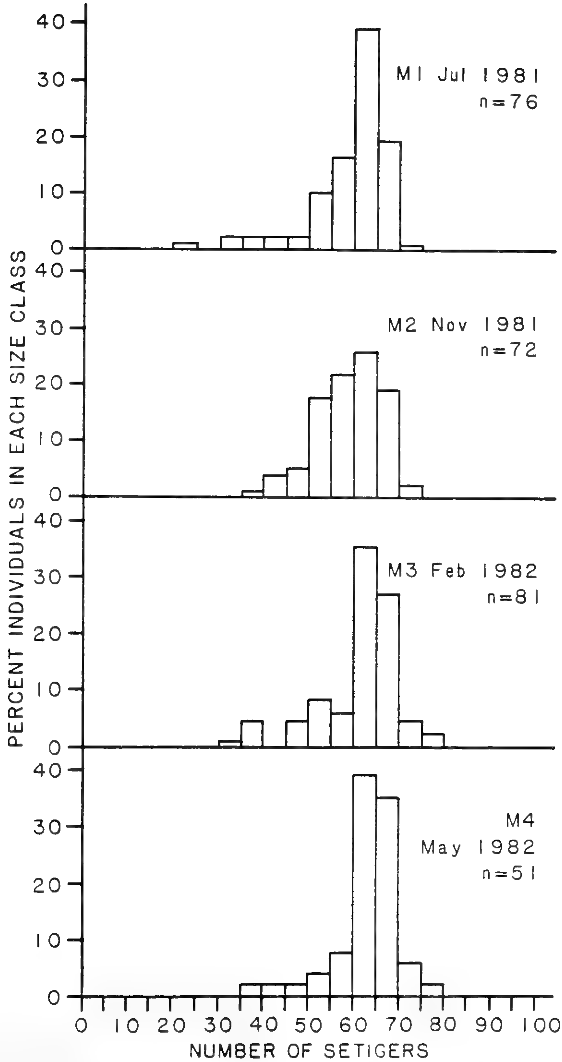


FIGURE 55. SIZE CLASS FREQUENCY OF <u>Tharyx</u> <u>annulosus</u> AT STATION 5-1.

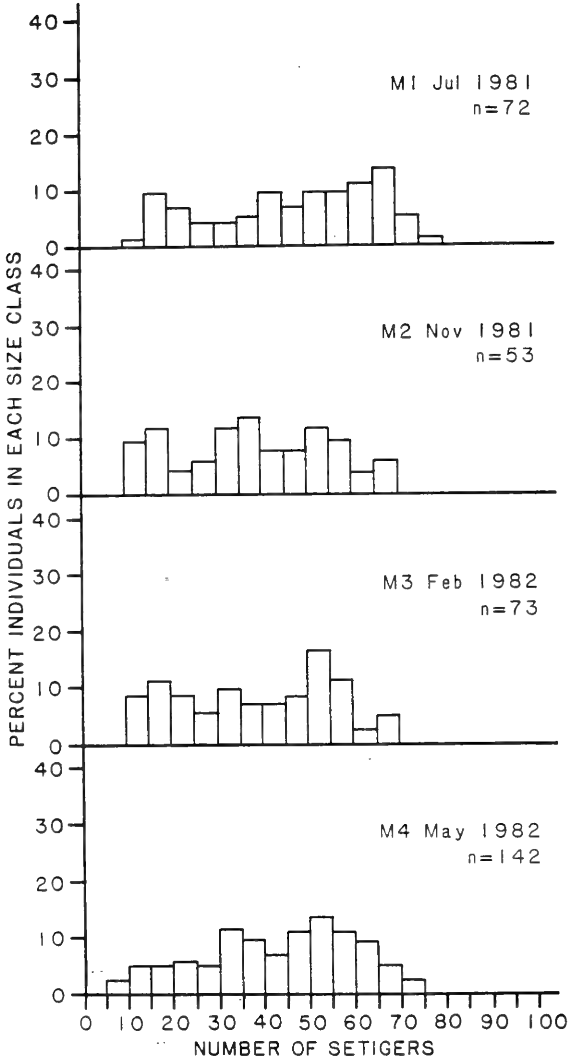


FIGURE 56. SIZE CLASS FREQUENCY OF Tharyx sp. A AT STATION 5-1.

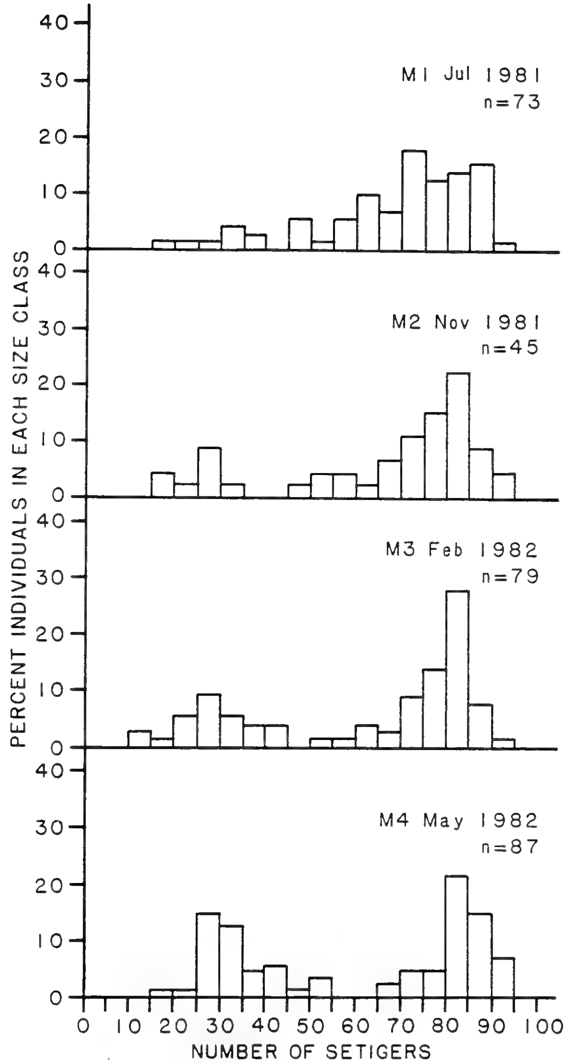


FIGURE 57. SIZE CLASS FREQUENCY OF <u>Tharyx</u> <u>acutus</u> AT STATION 5-1.

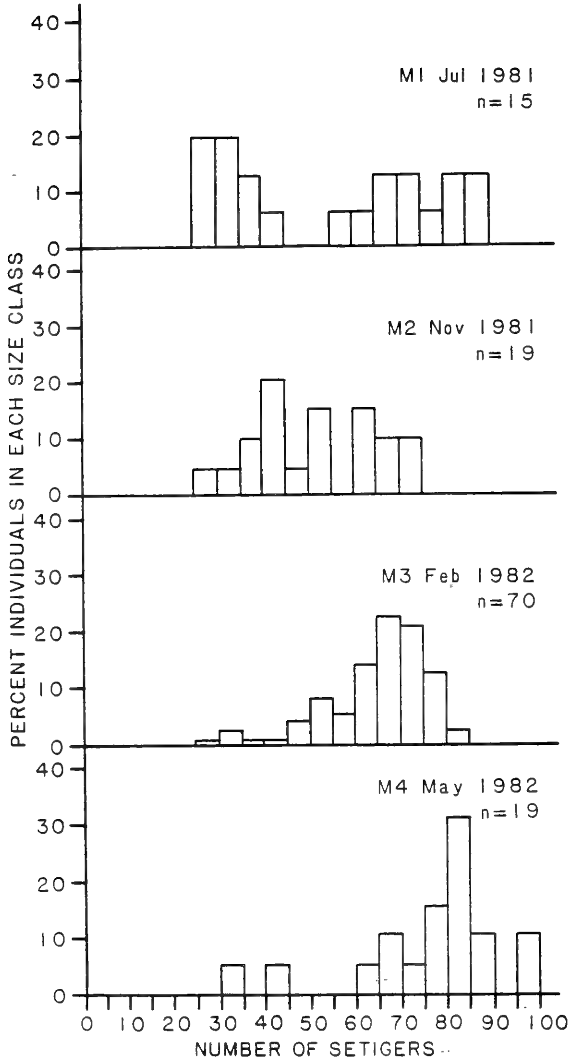


FIGURE 58. SIZE CLASS FREQUENCY OF Tharyx acutus AT STATION 13.

cirratulid, Tharyx dorsobranchialis, were determined to be too inconclusive and have therefore not been included in the results presented below.

Cossura longocirrata - Cossura longocirrata is a dominant species at Station 13. The species develops a beaded abdominal region with the onset of sexual maturity. The specimens frequently break at that point when preserved. Some specimens were observed to have a swollen region preceding the beaded region and some studies were undertaken to determine its significance. The swollen area is found most prominantly on females and is perhaps the site of oogenesis. With the onset of egg maturation, it is hypothesized that the eggs move posteriorly, the segments become beaded and the swollen area becomes less prominent. The males do not appear to exhibit a swollen stage. In the next year, we plan to section several specimens of these stages to prove or disprove this hypothesis.

Most males and females occurred in the summer collection (M1), although beaded individuals were present year-round. Juveniles having a range of 21-26 setigers or less comprised 23 percent of the spring collection. Thus, most juveniles occurred in the spring collection (M4). These data and the overall appearance of the age/size histograms strongly suggest a spring-summer reproduction and recruitment for this species (Figure 59).

Aricidea catherinae - Eighteen percent of the population at Station 13 were ripe females in the spring collection (M4). The small size classes appeared in the July collection (M1), followed by large numbers in November (M2) (Figure 60). These data suggest that recruitment took place in summer. It is possible to follow the juvenile cohort from M1 through M4. The disappearance of the large size classes after M1 suggests that the species has an annual cycle, with mortality after spawning.

Aricidea suecica - At Station 13, A. suecica undergoes gametogenesis in the winter and spring with spawning and recruitment taking place in the summer. The smallest size classes are present in M1 (July) and M2 (November) (Figure 61), but reproductive individuals are not present in those collections. Eggs are present in the winter (26 percent of females, M3) and spring (56 percent of females, M4).

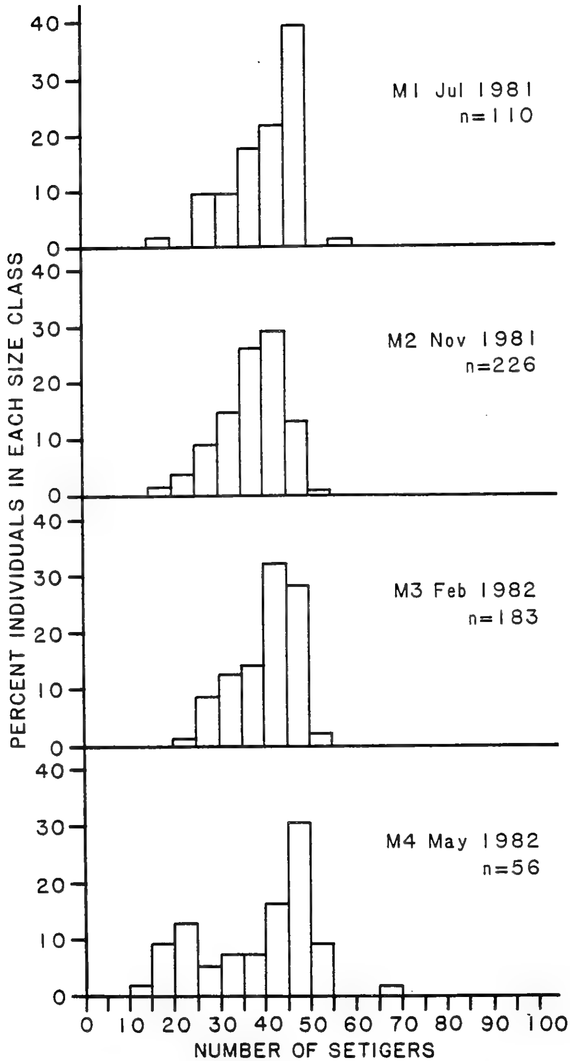


FIGURE 59. SIZE CLASS FREQUENCY OF Cossura longocirrata AT STATION 13.

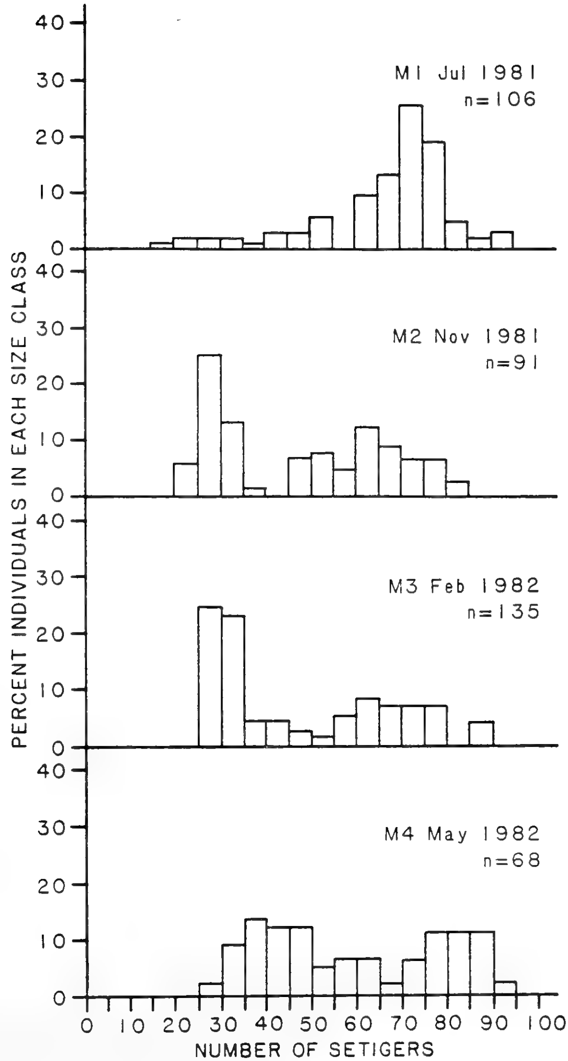


FIGURE 60. SIZE CLASS FREQUENCY OF Aricidea catherinae AT STATION 13.

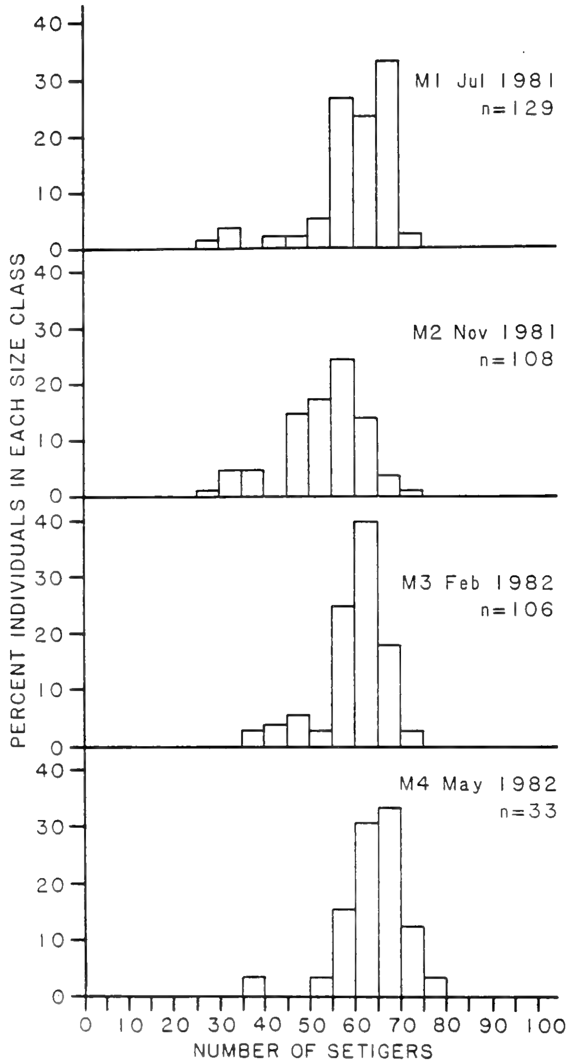


FIGURE 61. SIZE CLASS FREQUENCY OF Aricidea suecica AT STATION 13.

Levinsenia gracilis - At Station 13, Levinsenia gracilis size data are incomplete due to the lack of information on M4 specimens. We believe recruitment takes place in the summer, however, because the smallest size classes are present in the M1 collection (Figure 62). Eggs were not present in M1, but were present in the fall collection (M2).

5.4.3 Polychaetes from Block 410 Stations

In an attempt to learn something about the reproduction and recruitment of some dominant species from the deeper Block 410 stations, three species of Paraonidae were chosen for study: Paraonis sp. A, Paradoneis sp. A and Aricidea neosuecica.

For the first and third species, insufficient numbers were available from Station 18 to draw firm conclusions about seasonality and additional material from Stations 16 and 17 will be added during the coming year.

Aricidea neosuecica - The data are fragmentary for this species, since insufficient specimens were available from Station 18. We intend to add specimens from Stations 16 and 17 to expand the data during the next year.

Eggs were present in the winter and spring collections (M3 and M4), which suggests spawning and recruitment in late spring, or possibly early summer. The size class data are too fragmentary at this time to support this hypothesis (Figure 63).

Paraonis sp. A - Although the data are as yet scanty, it appears that reproduction, spawning, and subsequent recruitment of Paraonis sp. A took place during the summer and fall months. During the July sampling period (M1), 24 percent of the females in the population had a mean egg length of 56.2 μm. At the same time, 52 percent of the population were males. In the November sampling period, 43 percent of the population were females with mean egg diameters of 88 μm. The number of males was 53 percent. No females were recorded for the February sampling (M3), and there were less than 10 percent males in the population. The percentage of females (33 percent) and males again increased in the spring sampling period (67 percent), but egg diameters were small ($\bar{x}$=64.6 μm). The larger egg diameters recorded in the November sampling period corresponds to the time of appearance of the smallest size class (21-25 setigers) (Figure 64).

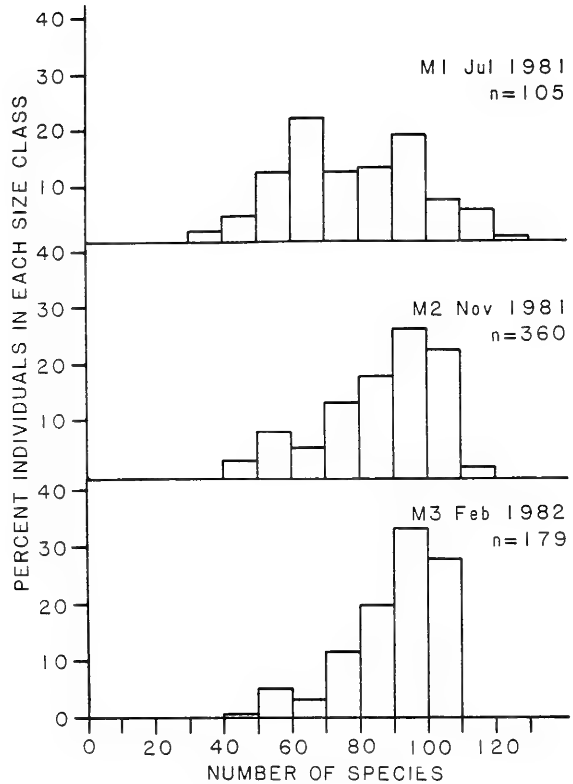


FIGURE 62. SIZE CLASS FREQUENCY OF <u>Levinsenia</u> <u>gracilis</u> AT STATION 13.

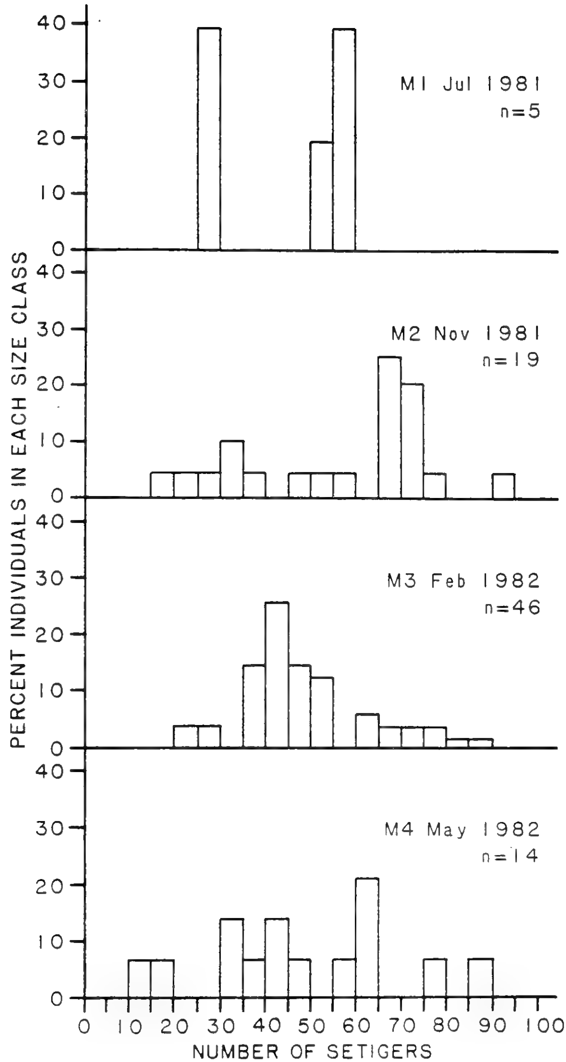


FIGURE 63. SIZE CLASS FREQUENCY OF Aricidea neosuecica AT STATION 18.

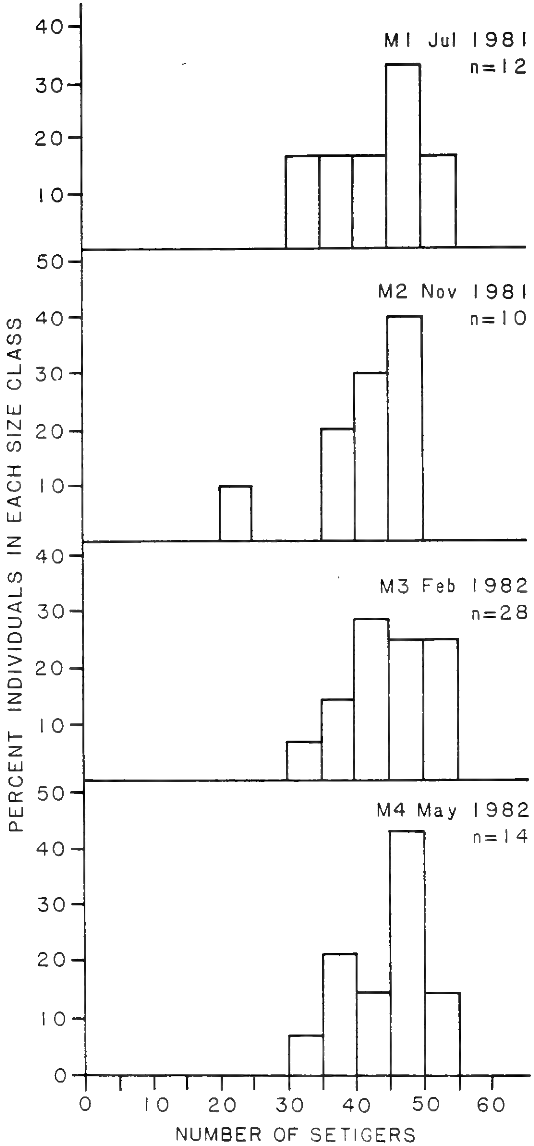


FIGURE 64. SIZE CLASS FREQUENCY OF Paraonis sp. A AT STATION 18.

Although the egg diameter data in particular are indicative of a late summer/fall spawning period, the numbers for age/size class are obviously low. We plan to add specimens from Stations 16 and 17 to supplement the Station 18 data.

Paradoneis n. sp. A - Paradoneis n. sp. A spawns in early spring. Evidence for this comes from analysis of gamete presence and the first appearance of juveniles in the population.

Large oblong-shaped eggs were present in specimens from the winter (M3) and spring (M4) collections. The eggs numbered 1-3 per female and averaged 120.4 x 55.4 μm in February and 111.1 x 78.2 μm in May. Spermatophores were present in M4 females.

The smallest specimens encountered were in the 16-20 setiger size range and these occurred in the July samples (Figure 65), which is expected if spawning had taken place in the preceding months.

This species is very small and was only rarely present on the 0.5 mm screen, most (99 percent) having passed through to the 0.3 mm screen. Thus, the presence of a few (1-3) very large eggs is not unexpected for species which are meiofaunal in habit. Further, the gametogenesis which takes place in winter, followed by a spring spawning is typical of many species lacking pelagic larvae, which we predict is the case for this species.

Important reviews of polychaete reproduction include those by Schroeder and Hermans (1975) and Olive and Clark (1978). The two most prevalent reproductive patterns are termed monotelic and polytelic. In monotelic reproduction, the majority of species undergo a pronounced metamorphosis of the body during gametogenesis in preparation to the spawning events. Such species breed only once and die shortly after spawning. Nereid polychaetes which develop epitoky are classic examples of this type of monotelic reproduction. In the present study, Cossura longocirrata may be a monotelic species. This conclusion is suggested by the precipitous decline in density in M4, which corresponds to the heaviest juvenile recruitment.

In polytelic reproduction, gametes are released in one of a few large batches, with adult survival and additional breeding occurring in the following year. Polytelic species may also produce more than one batch of gametes in a single season. The latter situation is relatively common in nearshore species of polychaetes. Most of the polychaetes in the present study are probably polytelic.

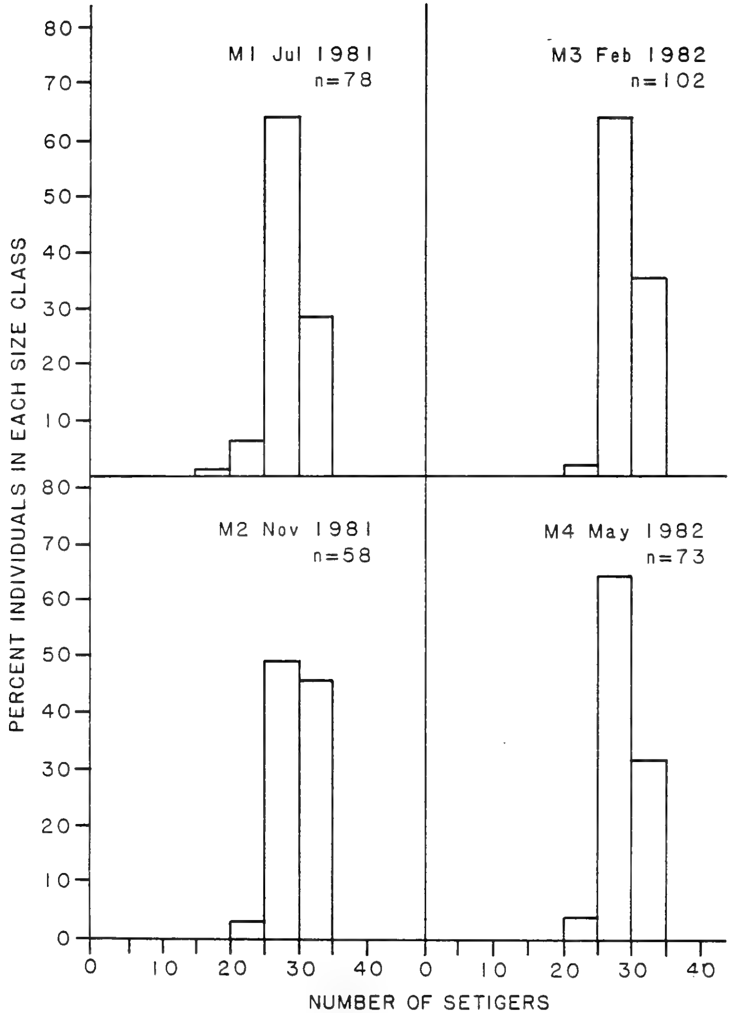


FIGURE 65. SIZE CLASS FREQUENCY OF <u>Paradoneis</u> sp. A AT STATION 16.

There is a significant body of literature growing on the reproductive biology of nearshore and intertidal species of polychaetes. To date, however, the literature on continental shelf species is limited.

In a study of an intertidal population of Streptosyllis websteri at Northumberland in the U.K., Garwood (1982) found the species to exhibit epigamous reproduction. In this situation, the reproductive individual becomes pelagic at the time of sexual maturity. In epigamous species, long accessory capillary setae develop between the dorsal cirrus and setal lobe on a number of middle body segments. These setae are also called "natatory setae". Garwood (1982) found evidence that S. websteri breeds twice during its spawning season, and speculated that a reversible epigamy was operative. He further suggested that reversible epigamy might be widespread among syllids of the subfamilies Eusyllinae and Exogoninae. Some additional evidence supporting this point of view includes that presented by Rasmussen (1973) who found Exogone naidina (as E. gemmifera) to have large oocytes while already brooding externally attached young. In the present study, evidence of epigamous setal development was present in all of the syllids examined. In some cases only 1-2 individuals were noted to have natatory setae. It is probable that the epigamous condition is brief, with natatory setae developing rapidly at the time of final gamete maturation. The animals swarm, undergo mating, return to the sediment, and lose the natatory setae. In such a situation, quarterly sampling would be too infrequent to observe large numers of epigamous individuals except by the lucky chance of sampling at a time when some of the population was ready to swarm.

Cirratulids are also known to exhibit natatory setae during their reproductive cycle (Blake, unpublished). In the present study, we observed natatory setae on Tharyx acutus and Tharyx sp. A. We also observed natatory setae on Aricidea neosuecica in M2 and M3 specimens, which appears to be the first record of epigamous setae in a paraonid.

There is little correlation between the faunal density data and the life history data developed for individual species. One exception is at Station 13, where the sharp declines in density of Cossura longocirrata in M4 correspond to the appearance of juveniles. This has already been suggested as possible evidence of monotelic reproduction in the species. A summary of the reproductive and recruitment events of the sixteen polychaete species discussed above is presented in Table 12.

TABLE 12. SUMMARY OF TIMING OF REPRODUCTION AND RECRUITMENT OF SPECIES STUDIED IN THE LIFE HISTORY ANALYSIS.

Species	July 1981 (M1)	Nov. 1981 (M2)	Feb. 1982 (M3)	May 1982 (M4)
Polychaetes				
Aricidea catherinae				
A. neosuecica	?			
A. suecica				
Cossura longocirrata				
Exogone hebes				
E. verugera				
Levinsenia gracilis	?			?
Paradoneis n. sp. A				
Paraonis sp. A				
Parapionsyllis longicirrata				
Sphaerosyllis cf. _brevifrons_				
Streptosyllis arenae				
Syllides benedicti				
Tharyx acutus				
T. annulosus				
_T._ sp. A	?	?		
Amphipods				
Ampelisca agassizi				
Ericthonius rubricornis				
Unciola inermis				

Major Recruitment — Major Reproductive Events

Some Recruitment — Reproductive Individuals Present

5.4.4 Amphipod Life History

Length-frequency distributions have been developed for Unciola inermis and Erichthonius rubricornis at Station 5-1 and for Ampelisca agassizi at Station 13 for Cruises M1 through M4 (Figures 66-68). Eggs develop and hatch in the marsupium formed by the brood plates on the female. The lengths of hatched juveniles within the marsupium are 1.4 mm for U. inermis and E. rubricornis and 1.8 mm for A. agassizi.

U. inermis is an annual species with the bulk of its recruitment occurring in May. Newly released individuals of E. rubricornis were present in the spring and fall, suggesting that this species may have two generations per year. The most conspicuous feature of the distribution of E. rubricornis is its virtual disappearance from Station 5-1 in February (M3) and the subsequent recolonization by adults in May (M4). The colonists could have migrated from the region to the east (Station 5-28) where the species remained abundant in February. A. agassizi is also an annual species but in contrast to U. inermis, recruitment appears to start in the late fall and continues into the early winter.

A common feature of the length-frequency distributions is that each generation appears to be composed of two pulses of recruitment. Bimodal recruitment is most distinct in U. inermis; in E. rubricornis and A. agassizi, the two peaks are apparent in July (M1) and less obvious at other seasons. Bimodality is less apparent in adult distributions because variation in individual growth rates obscures modes with time.

Mills (1967), studying the length-frequency distribution of Ampelisca abdita, found bimodality in both winter and summer generations. Corophium volulator, which has a similar life history as A. abdita, also has bimodal recruitment in winter and summer generations (Möller and Rosenberg, 1982). This evidence implies that the bimodality observed in related species as well as in those of the present study is a real phenonemon rather than a sampling or measuring artifact.

Reproductive summaries for these three amphipods and the 16 polychaete species are presented in Table 12. The recruitment data for amphipods are only from Cruises M1 through M4. The reproductive summaries are from other data assembled from Cruises M5 through M8. All three amphipod species exhibit some reproductive activity year-round. For Ampelisca agassizi, the most reproductive individuals were found in M5 (July); for E. rubricornis and U. inermis, the most reproductive individuals were found in M7 (February).

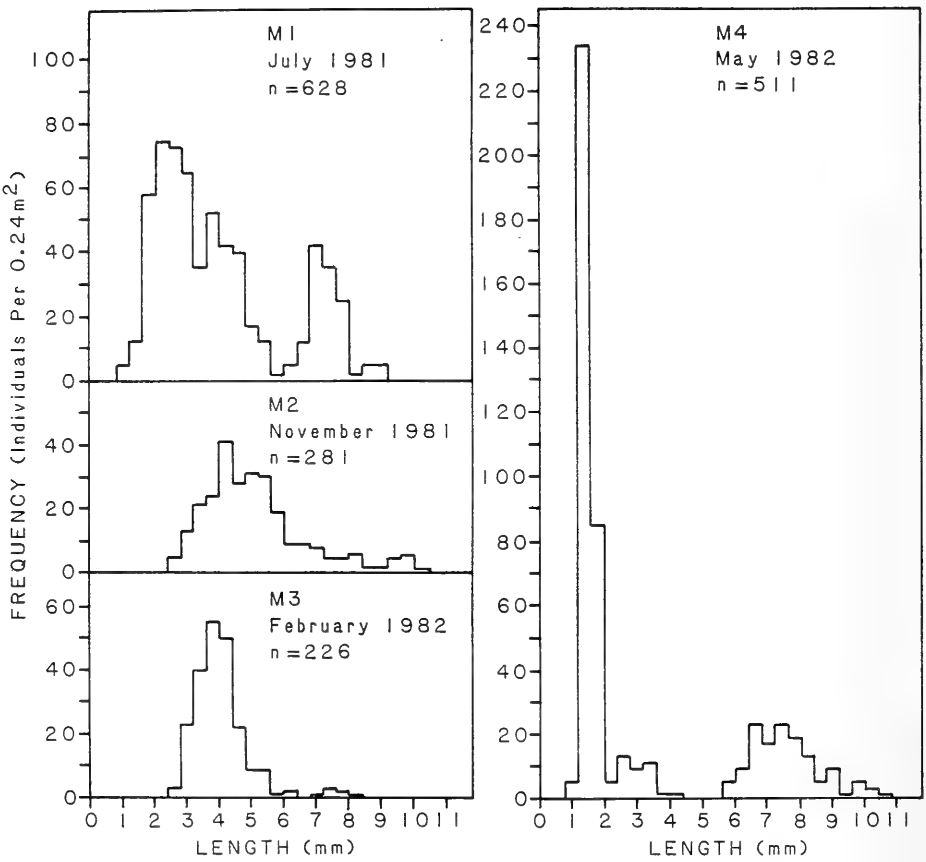


FIGURE 66. LENGTH-FREQUENCY DISTRIBUTIONS FOR Unciola inermis AT STATION 5-1.

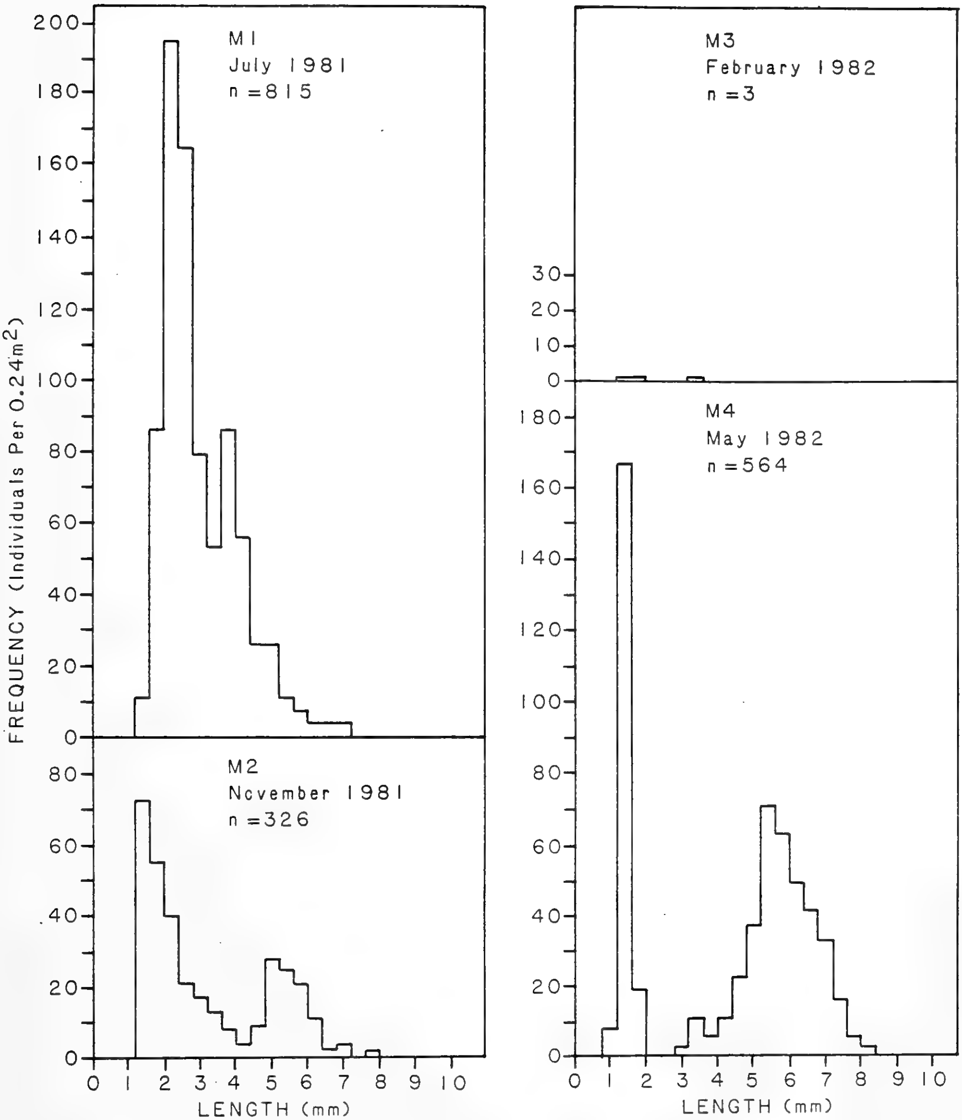


FIGURE 67. LENGTH-FREQUENCY DISTRIBUTIONS FOR Erichthonius rubricornis AT STATION 5-1.

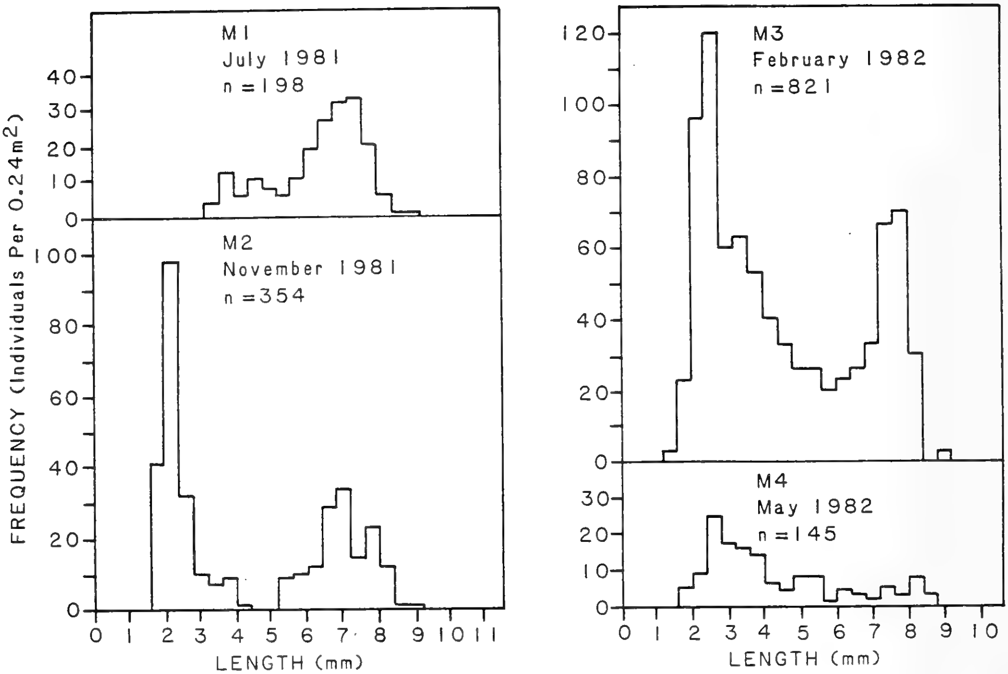


FIGURE 68. LENGTH-FREQUENCY DISTRIBUTIONS FOR Ampelisca agassizi AT STATION 13.

5.5 Production and Fish Feeding

Figure 69 shows the five most numerous prey species of yellowtail flounder, Limanda ferruginea, at each station and sampling date studied. Results are expressed as mean numbers of prey individuals per stomach. Only stomachs with recognizable prey items are considered in this analysis. In every case, one or two prey species constituted the bulk of the diet.

At Station 5-1, the diet was dominated by amphipods and to a lesser extent polychaetes. The diet at Station 10 was more seasonally variable than at the other two stations. During M5, pelagic prey predominated. Shrimps and crabs were important prey throughout the year; amphipods and polychaetes were less important. Amphipods and polychaetes were the dominant prey items at Station 13.

The mean number of prey per stomach varied both seasonally and between stations. Seasonal variation may be related to the reproductive cycle. Yellowtail flounder spawn from March to July with the peak usually occurring in mid-May. Langton (1983) found the mean weight of yellowtail flounder stomach contents to be greater in the spring than the fall. Spawning fish contained the least amount of prey in their stomachs, while fish with resting stage and developing gonads contained the most prey.

Fish caught at Station 5-1 had the highest mean number of prey per stomach, followed by those caught at Stations 13 and 10. The difference between Stations 5-1 and 10 could be explained by the observation that larger prey items were taken at Station 10; thus fewer items would provide equal weight. Langton (1983) found the total weight of stomach contents to be greater on Georges Bank than off Southern New England. This could explain why mean prey number was greater at Station 5-1 than at Station 13 where similar sized prey were taken.

Electivity indices were calculated to determine whether changes in prey composition reflect seasonal changes in benthic community composition. Constant electivity for a given prey species indicates that fish feeding mirrors changes in prey abundance; variable electivity implies that prey suitability or availability change during the year.

Three groups of prey species can be identified based on their occurrence in the fish diet and/or in the benthos. For this analysis, "numerous in the benthos" means that a

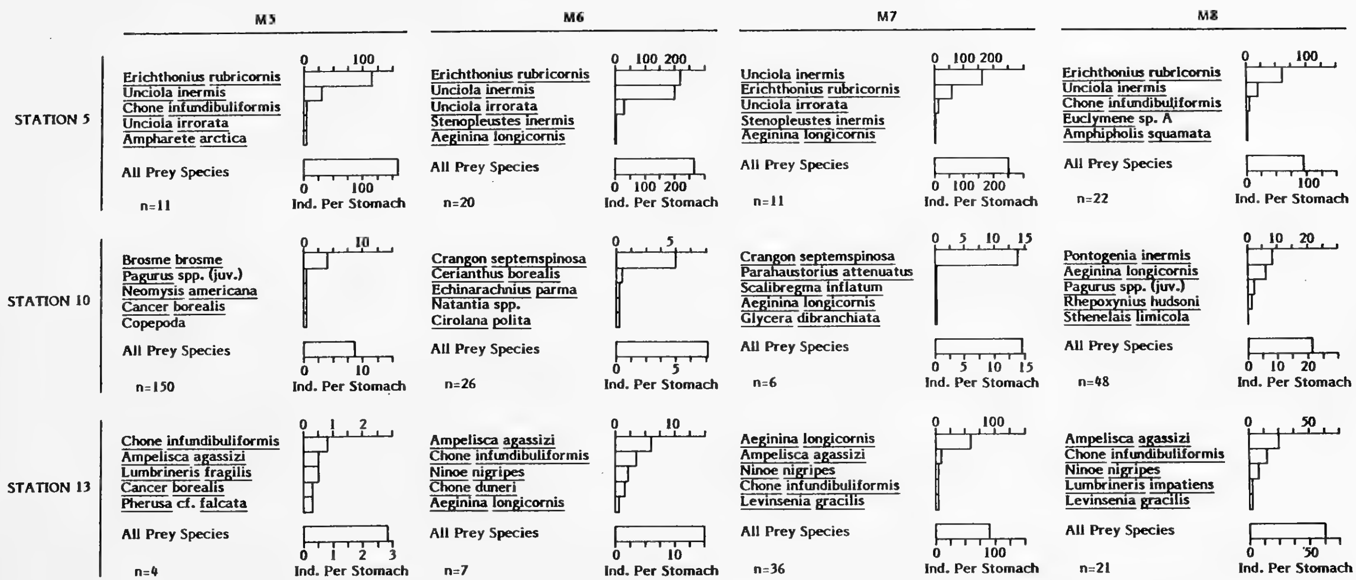


FIGURE 69. FIVE MOST NUMEROUS PREY SPECIES OF YELLOWTAIL FLOUNDER *Limanda ferruginea*. DATA ARE EXPRESSED AS THE MEAN NUMBER OF PREY INDIVIDUALS PER STOMACHS EXAMINED.

species was among the ten most abundant species at that station, as listed in Table 6. (The only exception is Nephtys incisa, which was the eleventh dominant species at Station 13.) "Numerous in the diet" means the species was among the 10 most abundant prey species at that station during at least two out of the four fish sampling cruises. "Less numerous" means that the species was not within the top ten dominants in the benthos or the diet. Group A consists of species which were numerous in the diet but less numerous in the benthos. Electivity indices are not given for pelagic species because they are under-represented in the grab samples. Group B contains species which were numerous in both diet and benthos. Species numerous in the benthos, yet less numerous in the diet, are in Group C. Electivity indices are not given for dominant species never eaten.

The dominant prey species at Station 5-1 (Figure 70), Erichthonius rubricornis, Unciola inermis, and U. irrorata, are all tubicolous amphipods. The other two amphipod species, Aeginina longicornis and Stenopleustes inermis, both live on hydroids. The sabellids, Chone infundibuliformis and C. duneri feed with tentacles above the surface; this could explain their positive electivity index. The remaining polychaete species are subsurface burrowers, making them less vulnerable to fish predation.

At Station 10 (Figure 71), there is less overlap between diet and benthos. During M5, the major prey were larvae of cusk, Brosme brosme. Crangon septemspinosa, the dominant prey during M6 and M7, was rare in the grab samples. The two most abundant amphipod species, Rhepoxynius hudsoni and Protohaustorius wigleyi, are both burrowers and both are approximately neutrally selected. Polygordius sp. A, the dominant polychaete at Station 10, is a subsurface burrower and may therefore not be vulnerable to predation.

Station 13 (Figure 72) had the greatest overlap between fish diet and macrobenthos. The surface-feeding polychaetes, Chone infundibuliformis, C. duneri, and Pherusa cf. falcata, are all positively selected. The dominant amphipod species, Ampelisca agassizi, is also positively selected except during M7. Ninoe nigripes, also a surface feeder, is approximately neutrally selected. The remaining, numerically dominant polychaetes are all sub-surface burrowers and are negatively selected.

Yellowtail flounder feed mainly during the daylight hours (Langton, 1983), which implies they are visual predators. Comparing between stations, the main prey of yellowtail flounder are animals that live on or near the sediment surface. The diet is

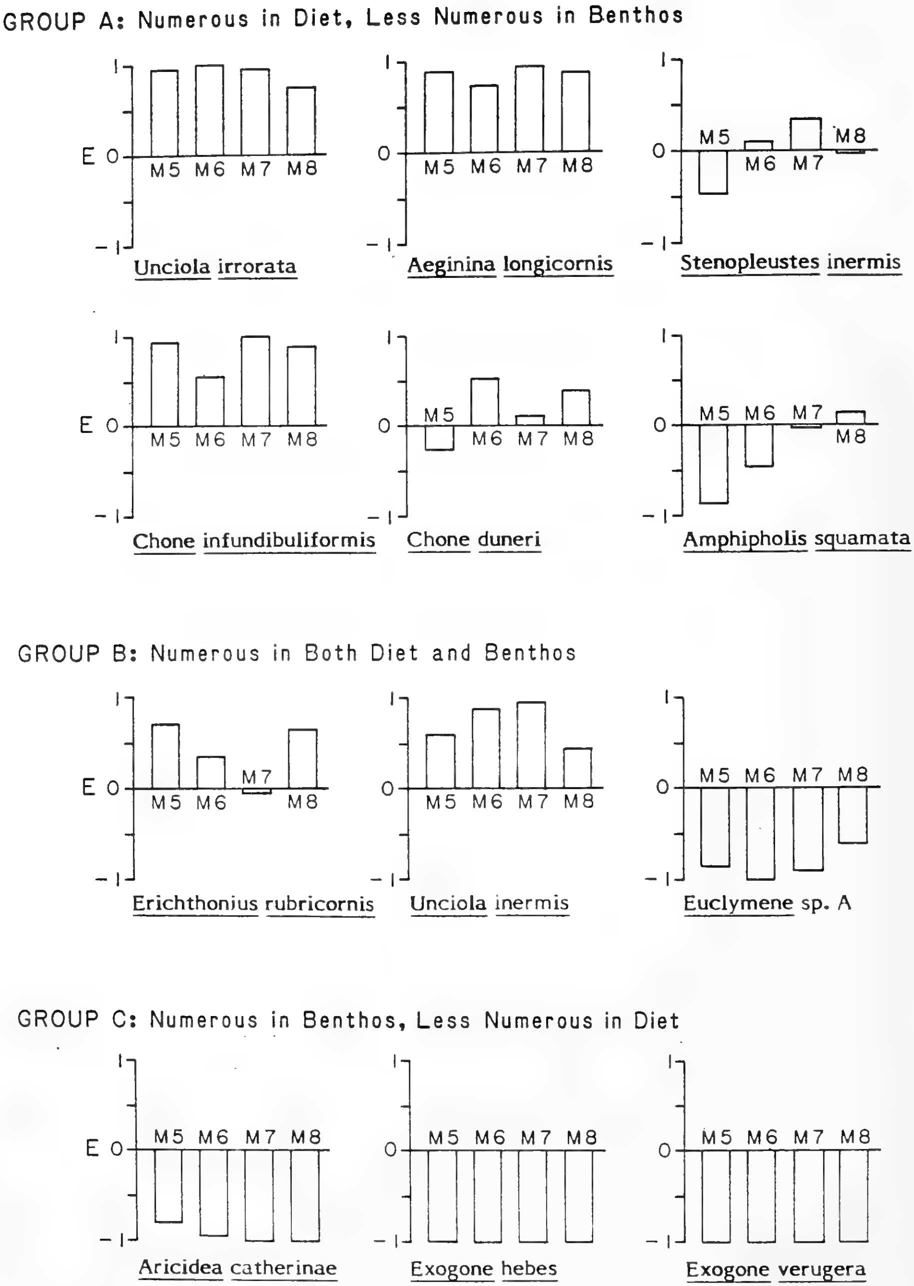
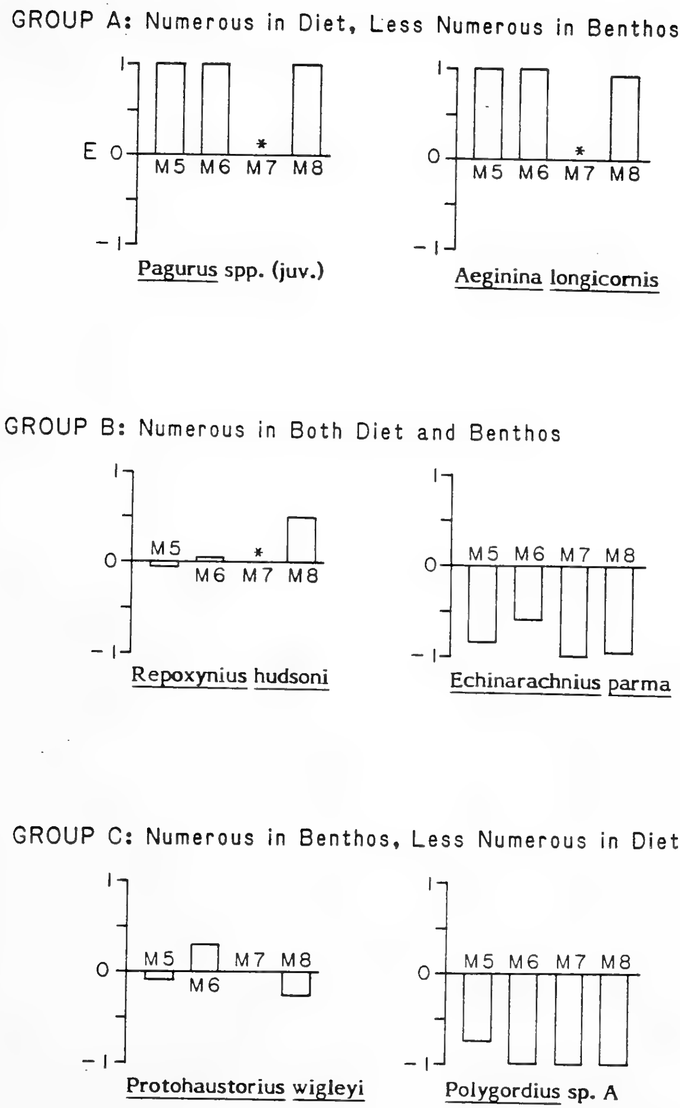
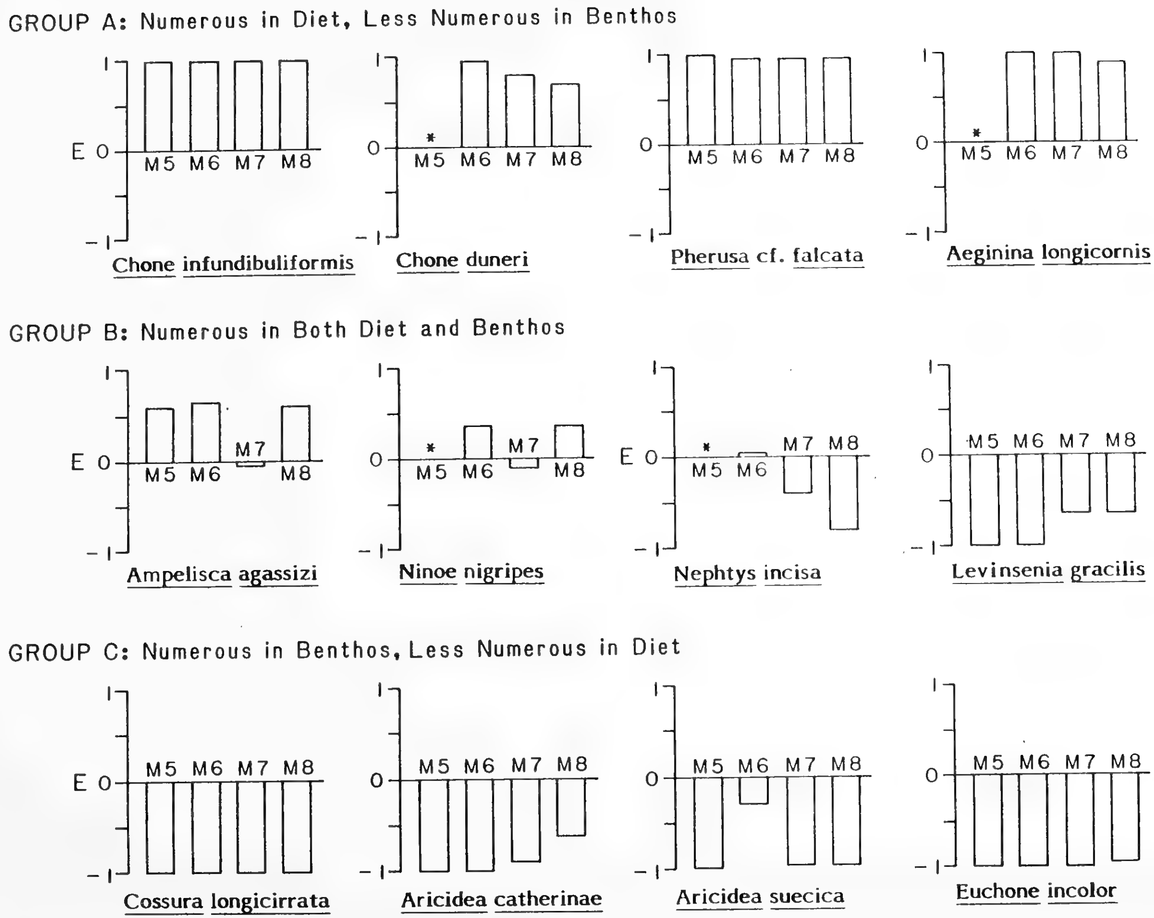


FIGURE 70. YELLOWTAIL FLOUNDER ELECTIVITY FOR BENTHIC PREY AT STATION 5.



*insufficient sample size

FIGURE 71. YELLOWTAIL FLOUNDER ELECTIVITY FOR BENTHIC PREY AT STATION 10.



*Insufficient sample size.

FIGURE 72. YELLOWTAIL FLOUNDER ELECTIVITY FOR BENTHIC PREY AT STATION 13.

plastic, in that the dominant prey species vary from station to station. On the other hand, the electivity values are consistent between stations. For example, Chone infundibuliformis, C. duneri, and Aeginina longicornis are always positively selected, while Aricidea catherinae is always negatively selected.

Seasonal variation in electivity indices may be due in part to size-specific predation. If fish feed primarily on adults of a given species, the electivity index would decrease when the proportion of juveniles is high. Unciola inermis, for example, releases its juveniles in the spring and early summer. This could explain the lower electivity values for M8 and M5. Ampelisca agassizi, on the other hand, releases its juveniles in the late fall and early winter; this could explain the low electivity for M7. The importance of size-selective predation will be discussed in the final report for Year 3.

5.6 Bottom Photographs

An Edgerton Deep-Sea Standard Camera (Benthos® Model 372) and an Edgerton Deep-Sea Standard Flash (Benthos® Model 382) instrumentation package were used to take approximately 20 bottom photographs per station. The stations for which useful film footage was obtained and analyzed for Cruises M5 through M8 are shown in Table 13. Stations photographed, number of frames exposed, and quality of the film were all affected by several factors.

During Cruise M5, several stations were photographed at an inadequate aperture setting. Test strips of film developed on-board during the cruise revealed the problem, which was corrected, and subsequent photographs were properly exposed. A similar problem occurred on Cruise M6, yet despite aperture adjustments, some photographs were unsatisfactory. It is possible that the camera or strobe were misaligned, resulting in poor lighting of the area photographed.

Severe weather and large swells hindered photographic efforts during most of Cruise M7. With the surging and listing of the boat, it was not possible to deploy camera equipment without a serious risk of loss or damage. Technical problems were once again the source of problems on cruise M8. The camera operated erratically on deck, but failed repeatedly underwater. The camera, strobe, and bottom switch were all examined and replaced and the complete wiring system examined for breaks. Although several stations

TABLE 13. STATIONS FROM WHICH USEFUL FILM FOOTAGE WAS OBTAINED ON GEORGES BANK MONITORING CRUISES

REGIONAL STATIONS

Cruise No.	1	2	3	4	5	6	7A	8	9	10	11	12	13	14	15	16	17	18
M-5		x	x	x		x	x	x	x	x	x					x	x	x
M-6	x	x	x	x		x	x	x	x	x	x	x			x	x	x	x
M-7	x	x	x										x					
M-8																		

SITE-SPECIFIC STATIONS

Cruise No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
M-5	x	x	x	x	x	x		x	x	x				x		x		x		x					x				x
M-6	x	x	x	x	x	x		x	x	x	x	x		x		x		x		x		x			x			x	x
M-7																													
M-8																													

were photographed when the camera appeared to be functioning properly, no usable bottom photographs were obtained.

There usually were 20 usable frames from stations photographed during Cruises M6 and M7; fewer of sufficient quality were obtained on Cruise M5.

Microtopography and density of visible epifauna were analyzed for each frame. A descriptive summary of these results is presented in Table 14. The information gathered from the analysis of bottom photographs complimented the results of the infaunal grab analyses in several ways. It confirmed the patchy distribution of certain species, particularly the sand dollar, Echinarachnius parma, whose numbers varied widely in replicate grab samples at Regional Stations 1, 4, and 10, and allowed the identification of epifauna and fish not normally observed in the grab samples. Seasonal changes in surface topography and detritus and biological cover also became apparent. In addition to species density and surface topography, photographs were examined for evidence of potential accumulation of drilling muds and cuttings around drilling sites. No such accumulation could be identified from the photographs examined.

5.6.1 Microtopography of Regional Stations

Similarities observed among regional stations in Year 1 (M1 through M4) photographs were also evident in the available photographs from Year 2 (M5 through M8). Several stations, generally those at the same depth interval, showed similarities in surface topography, amount of detritus or biological cover, and sediment type. Although some differences were observed between frames taken at a single station on a particular cruise, and also between cruises, the following general groupings of stations as defined in Year 1 were again evident in photographs taken in Year 2.

I. Stations 1, 4, and 10 - approximate depth 60 m

Sediment sandy, well-sorted, without detritus. Small amounts of fine shell hash in troughs of ripples. Small, discontinuous, asymmetrical ripples present.

TABLE 14. SUMMARY OF BOTTOM PHOTO ANALYSIS RESULTS FROM CRUISES M5 THROUGH M8

Stations	Biota	Microtopography
1	Dominated by Echinarachnius parma.	Sandy, without detritus or shell fragments. Ripples frequent, discontinuous, asymmetrical.
2	Dominated by E. parma; hydroid colonies common. Also present were asteroids, including Asteria vulgaris and Leptasterias tenera, hydroid colonies, sponges, gastropods and Urophycis sp.	Sandy with a slight amount of detritus and fine shell hash in some frames. Bottom sculptured or with irregular faint ripples.
3	Asteroids common, including Asterias vulgaris and Leptasterias tenera. Porifera, Anthozoa, Placopecten magellanicus and the fish Ophichthus cruentifer, Urophycis sp. and Raja sp. present.	Silt and sand with detritus and shell fragments. Bottom flat with few disturbed areas.
4	Dominated by E. parma hydroid colonies common; Gastropoda, Cancer sp., Asterias vulgaris, Leptasterias tenera and Raja sp. present.	Sandy without detritus; some large shell fragments, bottom sculptured.
5	Dominated by asteroids.	Sandy with some silt, detritus, and shell fragments.
6	Dominated by asteroids, also present were hydroid colonies, Anthozoa, flounder, Macrozoarces americanus, Myxine glutinosa, Ophichthus cruentifer and Urophycis sp.	Sand and silt with some fine detritus and shell fragments; bottom flat.
7	Low densities of Cancer sp., Macrozoarces americanus and Ophichthus cruentifer.	Sand and silt with very little detritus; bottom flat with biogenic features.
8	Many onuphiid polychaetes. Asteroids, sculpin, and Ophichthus cruentifer present.	Sand with a small amount of fine detritus and shell hash bottom flat with biogenic features.

TABLE 14. (Continued)

Stations	Biota	Microtopography
9	Anthozoa, *Leptasterias tenera* and *Urophycis* sp. present.	Sand and silt with a slight amount of fine detritus and shell hash. Bottom sculptured; ripples beginning to form in some frames.
10	*E. parma* common. Hydroid colonies and asteroids present.	Sand with very little detritus or shell hash. Bottom sculptured with irregular, faint ripples beginning to form in some frames.
11	*Leptasterias tenera* present. Other organisms present only in M6.	Sand, little or no detritus; bottom sculptured.
12	Dominated by *Asterias vulgaris*. Also present are Porifera, *Placopecten magellanicus* shells, asteroids, other than *A. vulgaris*, *Ophichthus cruentifer*, and *Urophycis* sp.	Sand with some silt, fine detritus, and shell hash. Bottom flat with biogenic features in most frames.
15	*Asterias vulgaris* and Porifera present.	Sand with fine detritus and shell hash. Bottom sculptured.
16	Asteroids and onuphiid polychaetes present.	Sand with fine detritus and a small amount of shell hash; bottom flat and smooth.
17	Asteroids, onuphiid polychaetes, *Ophichthus cruentifer*, and *Urophycis* sp. present.	Sand with a small amount of fine shell hash and detritus; bottom flat with some biogenic features.
18	*Cancer* sp., asteroids, and flounder present.	Sand and some silt with fine detritus and shell hash; bottom flat with some biogenic features.

II. Stations 2 and 11 - depth between 70 and 80 m

These two stations are similar to Stations 1, 4, and 10, but the sediment is coarser, with some fine detritus and small to large-sized shell fragments present. Bottom surface is sculptured or covered by small, linear ripples. Although photographs are available only from M7, Station 13 exhibits the same characteristics.

III. Stations 3, 6, and 12 - approximate depth 100 m

These stations are characterized by dark, silty sediment covered with detritus and many Arctica shells and fragments. The fragments are of all sizes and most are at least partially covered with detritus. The bottom is flat except for some biogenic features. Station 7A is similar, but there is less detritus and no shell fragments are present.

IV. Stations 8 and 9 - depth 145 m

Sediment is sand and silt, with a small amount of fine detritus and fine shell hash. Bottom surface is sculptured or flat. Biogenic features are evident, most are faint trails across the sediment.

V. Stations 16, 17, and 18 - depth 140-145 m

The Block 410 stations are situated very close together and their microtopography is very similar. Sediment consists of sand and silt with some fine and medium textured detritus. The bottom surface is flat but not smooth. Many biogenic features and disturbed areas are present.

The differences in these groups seem to be a function of the presence and strength of water currents. The shallower stations of Group I have obvious ripples and well-sorted sediment without detritus, indicating a higher energy environment. In contrast, the deeper stations of Groups II and III have relatively featureless surfaces with fine sediment, are littered with more shell fragments and possess a more uniform cover of detritus or biological material.

The degree of water movement varies not only between different areas but also between seasons. The photographs show similar seasonal changes for nearly all stations. This was observed in Year 1 at the Block 410 Stations 16, 17, and 18 (Battelle and W.H.O.I., 1983). In Year 2, this seasonality was present, although not as obvious, at

these stations (Figures 73 through 75). Seasonal differences were apparent at Station 2, but not observed at Station 3, the only other station for which useful footage was obtained from Cruises M6 and M7 (Figures 76 through 78). Station 3 is located at a greater depth than Station 2, and the bottom is covered with many Arctica shells and fragments.

There are concurrent changes in surface topography and detritus cover. The amount of detritus is reduced as the bottom becomes more contoured and ripples begin to form. Photographs from M1 and M4 were most similar, reflecting more stable conditions during July, 1981 and May, 1982. The bottom has less contour and the fine detritus is uniformly distributed. Photographs taken during Cruise M2 in November, 1981 and Cruise M3 in February, 1982 show irregular surface topography and patchy, coarser detritus. The photographs from M3, in particular, show rippled sediment at most stations.

The greatest seasonal differences in Year 2 were observed between M5 and M6 at Station 2. Consistent with previous results, the M5 (July) photographs reveal regular, asymmetrical ripples and M6 (November) frames show an irregularly sculptured surface interrupted with deeper troughs.

5.6.2 Microtopography of Site-Specific Stations

The site-specific stations, located around Station 5-1 at an average depth of 80 m, are all very similar. During the more stable conditions of M1 and M5 (both July samples), most were characterized by poorly sorted, sandy sediment with some silt; a fairly uniform cover of medium-to-coarse detritus; shell fragments of all sizes; and flat surface topography with many biogenic features.

Consistent seasonal changes could be seen in nearly all site-specific stations as in the regional stations (Figures 79 and 80). Photographs from M3 and M6 (February, 1982 and November, 1982) showed what appears to be coarser sediment (although at least in M3 this is contrary to the results of the sediment grain size analysis), with less detritus present (M3) or patchy, clumped detritus (M6), less fine shell hash and more large fragments. The bottom was not smooth, but irregular and sculptured, sometimes with large troughs present.

There are several site-specific stations with unique characteristics. Site-Specific Station 5-29 is distinct in the greater amount of Arctica shells and fragments

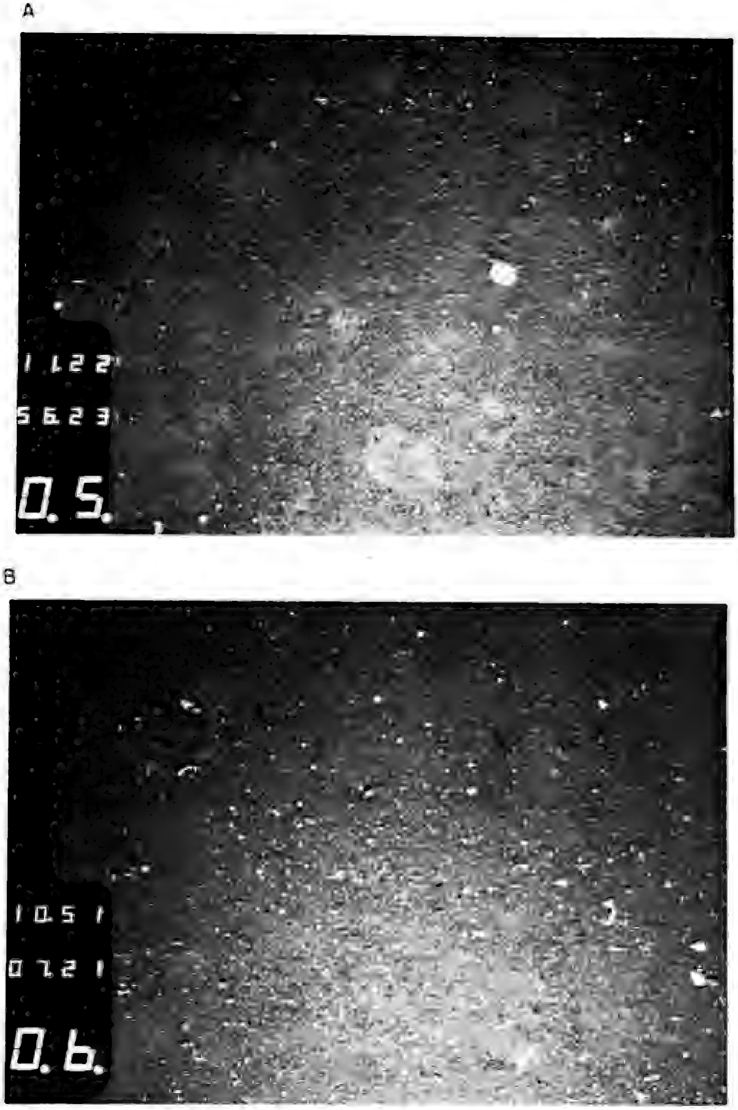


FIGURE 73. REGIONAL STATION 16.
A. JULY, 1982 (M5); B. NOVEMBER, 1982 (M6).
SEASONAL DIFFERENCES IN SURFACE TOPOGRAPHY AND DETRITUS COVER WERE VERY SLIGHT AT THIS STATION DURING YEAR 2.

A

B

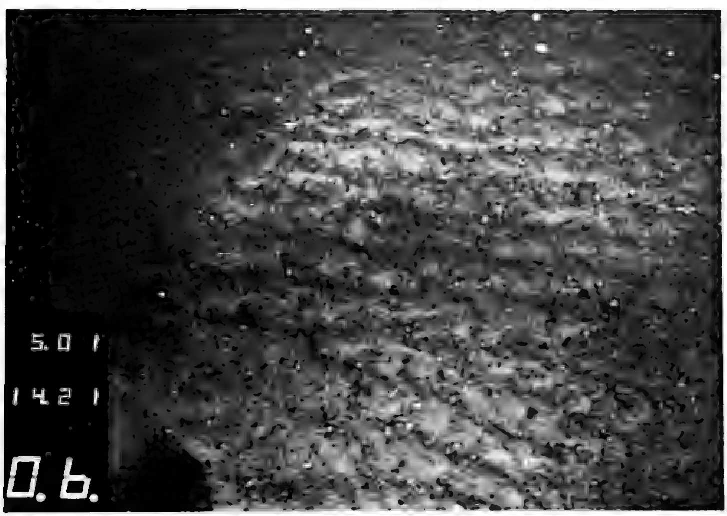


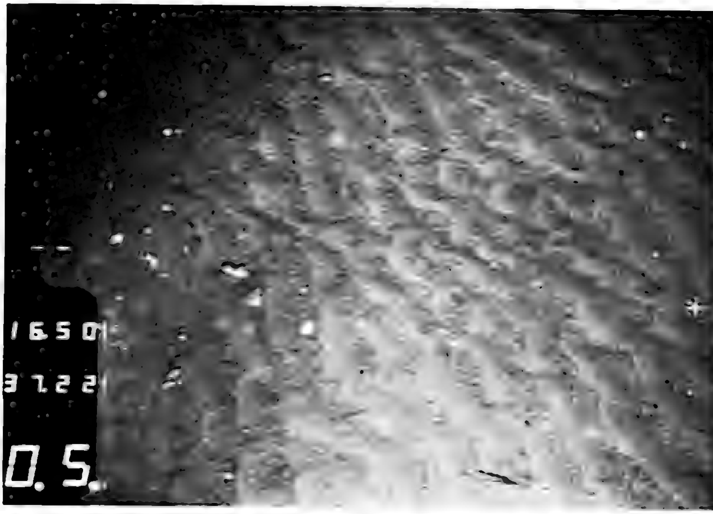
FIGURE 74. REGIONAL STATION 17.
A. JULY, 1982 (M5); B. NOVEMBER, 1982 (M6).
SEASONAL VARIATION IN SURFACE TOPOGRAPHY AND DISTRIBUTION OF DETRITUS AND SHELL FRAGMENTS ARE PRESENT.

A

B

FIGURE 75. REGIONAL STATION 18.
A. JULY, 1982 (M5); B. NOVEMBER, 1982 (M6).
SURFACE TOPOGRAPHY OF PHOTO B, NOVEMBER, 1982 (M6) IS MORE IRREGULAR AND DETRITUS COVER LESS UNIFORM THAN THAT SEEN IN PHOTO A, JULY, 1982 (M5).

A



B

FIGURE 76. REGIONAL STATIONS 2 AND 3.
A. REGIONAL STATION 2 JULY, 1982 (M5);
B. REGIONAL STATION 3 JULY, 1982 (M5).
CONTRAST IN SURFACE TOPOGRAPHY AND DETRITUS/BIOLOGICAL COVER OBVIOUS BETWEEN REGIONAL STATIONS 2 AND 3 DURING THE MONTH OF JULY, 1982 (M5).

A

B

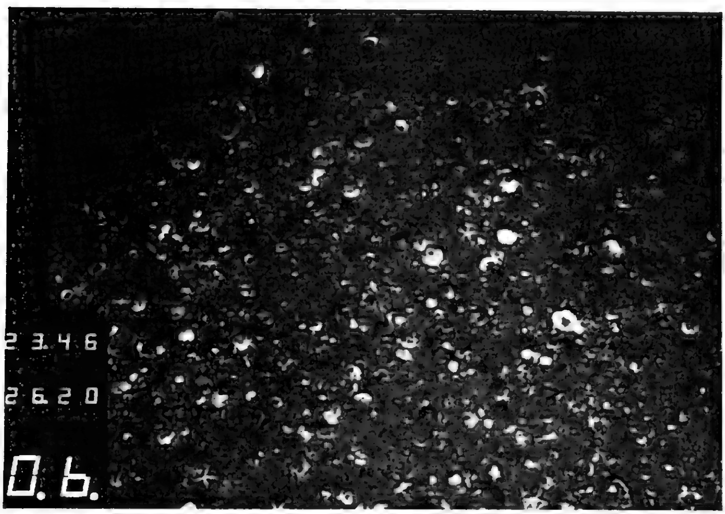
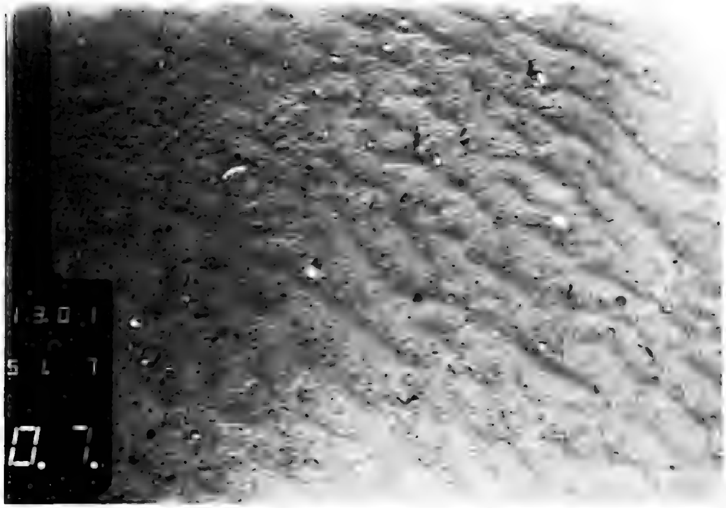


FIGURE 77. REGIONAL STATIONS 2 AND 3.
A. REGIONAL STATION 2 NOVEMBER, 1982 (M6).
B. REGIONAL STATION 3 NOVEMBER, 1982 (M6).
SURFACE TOPOGRAPHY HAS BECOME MORE IRREGULAR AT STATION 2 (PHOTOGRAPH A) FROM THAT OBSERVED IN JULY (FIGURE 76, PHOTOGRAPH A) WHILE STATION 3 (PHOTOGRAPH B) REVEALS NO SEASONAL VARIATION.

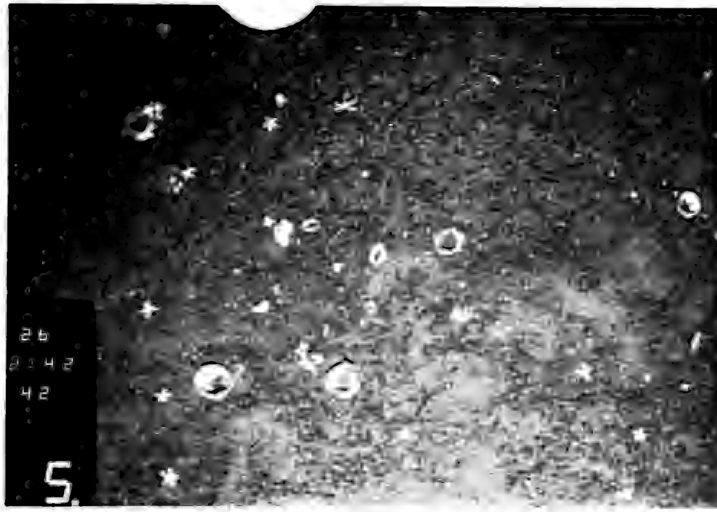
A



B

FIGURE 78. REGIONAL STATIONS 2 AND 3.
A. REGIONAL STATIONS 2 FEBRUARY, 1983 (M7);
B. REGIONAL STATION 3 FEBRUARY, 1983 (M7).
SURFACE CHARACTERISTICS OF STATION 2 RETURN TO WHAT WAS SEEN IN JULY, 1982 (M5) (FIGURE 76, PHOTOGRAPH A). STATION 3 REMAINS SIMILAR TO THE TWO PREVIOUS SEASONS, M5 AND M6 (FIGURES 76 AND 77, PHOTOGRAPH B).

A



B

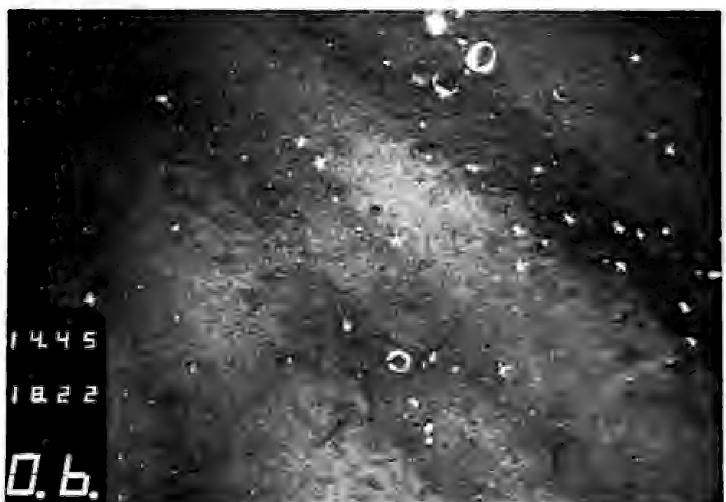
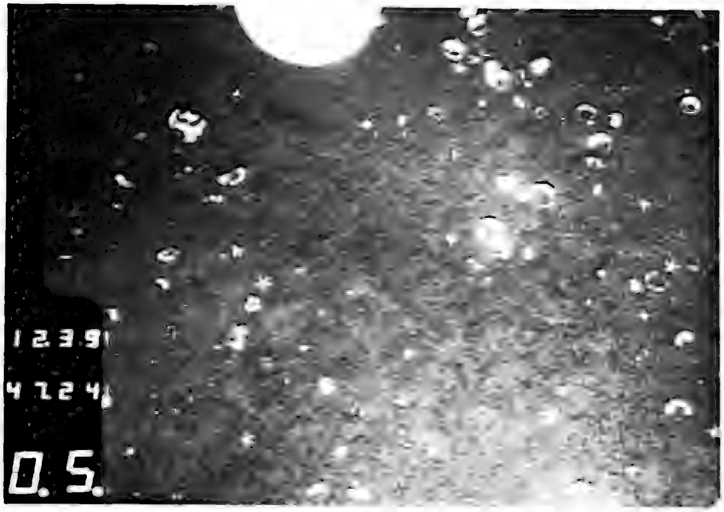


FIGURE 79. SITE-SPECIFIC STATION 5-1.
A. JULY, 1982 (M5); B. NOVEMBER, 1982 (M6).
Asterias vulgaris AND Arctica SHELLS PRESENT IN BOTH PHOTOGRAPHS. SEASONAL CHANGES IN BOTH SURFACE TOPOGRAPHY AND DETRITUS COVER ARE EVIDENT.

A



B

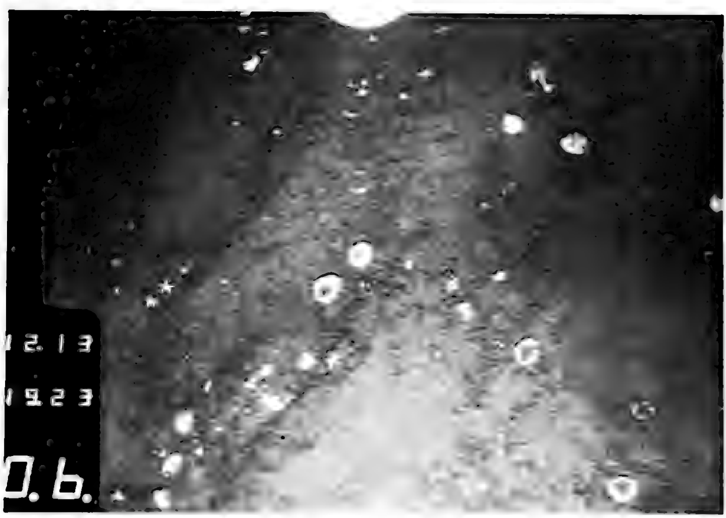


FIGURE 80. SITE-SPECIFIC STATION 5-10.
A. JULY, 1982 (M5); B. NOVEMBER, 1982 (M6). Asterias vulgaris AND Arctica SHELLS ARE PRESENT IN BOTH PHOTOGRAPHS. SIMILAR SEASONAL CHANGES AS SEEN AT SITE-SPECIFIC STATION 5-1 ARE EVIDENT.

covering its surface. The fragments vary in size and most are at least partially covered by sediment. No seasonal changes were evident for this station in Years 1 or 2. The only other site-specific station for which this was true was Station 5-25, which showed only slight differences between seasons.

5.6.3 Densities

In photographs from Cruises M5 through M8, 19 taxa of organisms were visible, including 12 invertebrates and 8 fish. Shells of Arctica islandica and Placopecten magellanicus were also present and noted. Densities per square meter were calculated for each taxon in each frame and averaged for each station (Tables 15 and 16). The area included in each frame was assumed to be approximately 1 m^2. If the camera was triggered by the bottom switch while at an angle, the area included in one frame would include an area greater than 1 m^2. As a result, the accuracy of the density values are affected and the quantitative value of these tables is limited.

Echinarachnius parma sometimes occurred in dense patches and could not be counted accurately: in these cases, a - or + indicates relative abundance. Onuphid polychaetes were not individually counted because of their number and size, and their abundance is represented in the same way.

At regional stations, Echinarachnius parma was the most common species, although it occurred only at Stations 1, 4, and 10. Shells of Arctica islandica were found at all but two stations and were very numerous in some frames. Asteroid echinoderms were the next most common organisms and were present at all but three stations. Also observed, but in lower densities, were hydroid colonies, sponges, Placopecten magellanicus, Cancer sp., anemones, and a hermit crab. The most common fish taxa were Urophycis sp. and Ophichthus cruentifer. Also present were Macrozoarces americanus, Myxine glutinosa and Raja sp.

Asteriod echinoderms were numerous at all site-specific stations, Leptasterias tenera being the most common species. Shells of Arctica islandica were also present at all site-specific stations. Hydroid colonies, sponges, Placopecten magellanicus, Cancer sp., and hermit crabs were present in lesser numbers. Fish observed at these stations were Urophycis sp., Raja sp., Lophius americanus, Macrozoarces americanus, and Ophichthus cruentifer.

TABLE 15. AVERAGE DENSITY PER SQUARE METER OF EPIBENTHIC MACROFAUNA IDENTIFIED IN BOTTOM PHOTOGRAPHS TAKEN AT GEORGES BANK BENTHIC MONITORING PROGRAM REGIONAL STATIONS.

		M-5	M-6	M-7
Sta. 1	Arctica islandica (empty shells)		0.1	0.2
	Echinarchnius parma		57.2	50.0
Sta. 2	Porifera	0.1	0.1	1.0
	Hydroid colonies	0.2	3.2	3.7
	Gastropoda	-	0.05	0.2
	Arctica islandica (empty shells)	-	3.0	-
	Placopecten magellanicus	0.05	0.1	-
	Placopecten magellanicus (empty shells)	-	0.05	-
	Echinarchnius parma	19.0	-	12.8
	Asteroidea	0.2	0.1	-
	Asterias sp.	-	-	1.5
	Leptasterias tenera	0.1	-	-
	Urophycis sp.	0.05	0.05	-
Sta. 3	Porifera	0.1	-	0.6
	Anthozoa	-	-	0.05
	Arctica islandica (empty shells)	X	+	+
	Placopecten magellanicus	0.5	-	0.05
	Asteroidea sp.	2.0	4.1	0.3
	Asterias sp.	-	1.4	1.6
	Leptasterias tenera	-	-	0.1
	Ophichthus cruentifer	0.1	-	-
	Urophycis sp.	1.0	0.2	-
	Raja sp.	-	0.1	-
Sta. 4	Hydroid colonies	7.2	8.9	
	Gastropoda	-	0.1	
	Arctica islandica (empty shells)	18.2	4.6	
	Cancer sp.	0.2	0.1	
	Echinarachnius parma	X	69.7	
	Asterias sp.	-	0.7	
	Leptasterias tenera	0.1	-	
	Raja sp.	-	0.1	
Sta. 6	Hydroid colonies	-	0.1	
	Anthozoa	-	0.1	
	Arctica islandica (empty shells)	+	+	
	Asteroidea	0.9	0.1	
	Flounder sp.	0.1	-	

TABLE 15. (Continued)

		M-5	M-6	M-7
Sta. 6 (cont.)	Macrozoarces americanus	0.1	-	
	Myxine glutinosa	0.1	-	
	Ophichthus cruentifer	0.1	-	
	Urophycis sp.	0.3	0.2	
Sta. 7	Arctica islandica (empty shells)	-	0.1	
	Cancer sp.	0.1	0.1	
	Macrozoarces americanus	0.1	-	
	Ophichthus cruentifer	0.5	-	
Sta. 8	Onuphid polychaetes	+	+	
	Arctica islandica (empty shells)	1.2	0.4	
	Asteroidea	0.4	0.4	
	Ophichthus cruentifer	-	0.1	
	Sculpin	0.1	-	
Sta. 9	Anthozoa	-	0.1	
	Arctica islandica (empty shells)	2.4	3.1	
	Leptasterias tenera	0.2	-	
	Urophycis sp.	-	0.4	
Sta. 10	Hydroid colonies	0.1	0.6	
	Arctica islandica (empty shells)	0.5	0.8	
	Echinarachnius parma	X	-	
	Asterias sp.	0.2	4.15	
Sta. 11	Porifera	-	0.1	
	Hydroid colonies	-	0.6	
	Arctica islandica (empty shells)	3.0	18.5	
	Placopecten magellanicus (empty shells)	-	0.1	
	Gastropoda	-	0.1	
	Cancer sp.	-	0.1	
	Hermit crab	-	0.1	
	Asteroidea	-	0.3	
	Asterias sp.	-	0.3	
	Leptasterias tenera	0.5	-	
	Ophichthus cruentifer	-	0.4	

TABLE 15. (Continued)

		M-5	M-6	M-7
Sta. 12	Porifera		0.1	
	Arctica islandica (empty shells)		5.5	
	Placopecten magellanicus (empty shells)		0.1	
	Asteroidea		0.1	
	Asterias sp.		10.8	
	Ophichthus cruentifer		0.1	
	Urophycis sp.		0.1	
Sta. 13	Hydroid colonies			X
	Asteroidea			X
Sta. 15	Porifera		0.01	
	Asterias sp.		2.0	
Sta. 16	Onuphid polychaetes	-	X	
	Arctica islandica (empty shells)	1.7	1.1	
	Asteroidea	1.3	0.5	
Sta. 17	Onuphid polychaetes	X	X	
	Arctica islandica (empty shells)	2.6	0.8	
	Asteroidea	1.0	0.6	
	Ophichthus cruentifer	-	0.1	
	Urophycis sp.	0.1	-	
Sta. 18	Cancer sp.	-	0.1	
	Arctica islandica (empty shells)	7.2	3.5	
	Asteroidea	0.2	0.2	
	Flounder	-	0.1	

+ indicates a thick cover, density impossible to estimate accurately.
X indicates organism is present, density impossible to estimate accurately.

TABLE 16. AVERAGE DENSITY PER SQUARE METER OF EPIBENTHIC MACROFAUNA IDENTIFIED IN BOTTOM PHOTOGRAPHS TAKEN AT GEORGES BANK BENTHIC MONITORING PROGRAM SITE-SPECIFIC STATIONS.

		M-5	M-6
Sta. 5-1	Hydroid colonies	0.3	0.1
	Arctica islandica (empty shells)	3.5	5.6
	Cancer sp.	0.1	-
	Placopecten magellanicus	0.1	-
	Leptasterias tenera	16.7	8.8
	Urophycis sp.	0.1	-
Sta. 5-2	Hydroid colonies	-	0.1
	Gastropoda	0.1	-
	Arctica islandica (empty shells)	2.2	8.7
	Placopecten magellanicus (empty shells)	0.1	-
	Cancer sp.	-	0.1
	Hermit crab	0.1	-
	Leptasterias tenera	17.2	6.3
	Lophius americanus	-	0.1
	Urophycis sp.	-	0.1
Sta. 5-3	Hydroid colonies	0.1	0.2
	Arctica islandica (empty shells)	3.8	2.0
	Placopecten magellanicus	0.1	0.1
	Cancer sp.	0.1	-
	Asteroidea	0.1	-
	Leptasterias tenera	16.6	8.7
	Macrozoarces americanus	0.1	-
Sta. 5-4	Hydroid colonies	0.1	0.2
	Arctica islandica (empty shells)	9.15	5.3
	Placopecten magellanicus (empty shell)	0.1	0.1
	Leptasterias tenera	13.4	4.7
	Macrozoarces americanus	0.1	-
	Urophycis sp.	0.2	-
	Raja sp.	-	0.1
Sta. 5-5	Arctica islandica (empty shells)	3.4	3.5
	Placopecten magellanicus	0.1	-
	Cancer sp.	0.1	-
	Asteroidea	0.1	-
	Leptasterias tenera	15.1	7.0
	Flounder	0.1	-
	Urophycis sp.	0.1	-

TABLE 16. (Continued)

		M-5	M-6
Sta. 5-6	Arctica islandica (empty shells)	8.01	6.9
	Placopecten magellanicus	-	0.1
	Placopecten magellanicus (empty shells)	-	0.1
	Leptasterias tenera	17.0	6.7
	Urophycis sp.	0.1	-
Sta. 5-8	Porifera	0.1	-
	Hydroid colonies	0.1	-
	Gastropoda	-	0.1
	Arctica islandica (empty shells)	3.9	1.8
	Placopecten magellanicus	0.1	0.1
	Asterias sp.	-	-
	Leptasterias tenera	16.6	4.6
	Flounder sp.	-	0.1
Sta. 5-9	Hydroid colonies	-	0.1
	Arctica islandica (empty shells)	6.4	5.9
	Placopecten magellanicus	-	0.1
	Placopecten magellanicus (empty shells)	0.1	0.1
	Cancer sp.	0.1	-
	Leptasterias tenera	14.3	8.6
Station 5-10	Porifera	-	-
	Hydroid colonies	0.2	0.1
	Arctica islandica (empty shells)	11.5	9.0
	Placopecten magellanicus	-	0.1
	Placopecten magellanicus (empty shells)	0.1	0.1
	Leptasterias tenera	12.2	7.4
	Ophichthus cruentifer	0.1	-
	Urophycis sp.	0.1	-
Sta. 5-11	Hydroid colonies		0.1
	Arctica islandica (empty shells)		4.7
	Placopecten magellanicus		0.1
	Leptasterias tenera		6.9
	Urophycis sp.		0.1
Sta. 5-12	Hydroid colony		0.1
	Arctica islandica (empty shells)		0.2
	Asteroidea		0.1
	Leptasterias tenera		5.8

TABLE 16. (Continued)

		M-5	M-6
Sta. 5-14	Hydroid colonies	0.1	-
	Arctica islandica (empty shells)	4.5	3.8
	Placopecten magellanicus	0.1	-
	Placopecten magellanicus (empty shells)	0.2	0.1
	Leptasterias tenera	16.4	9.8
Sta. 5-16	Hydroid colonies	0.4	-
	Arctica islandica (empty shells)	3.3	2.3
	Leptasterias tenera	21.4	6.1
	Lophius americanus	0.1	-
	Raja sp.	0.1	0.1
Sta. 5-18	Porifera	0.1	-
	Hydroid colonies	0.4	0.1
	Arctica islandica (empty shells)	10.6	6.2
	Cancer sp.	0.1	-
	Hermit crab	0.1	-
	Leptasterias tenera	15.1	7.3
	Lophius americanus	0.1	-
	Raja sp.	0.1	-
Sta. 5-20	Arctica islandica (empty shells)	1.2	-
	Placopecten magellanicus	0.1	-
	Placopecten magellanicus (empty shells)	0.1	-
	Asteroidea	0.1	-
	Leptasterias tenera	12.6	5.9
	Flounder	0.1	-
	Lophius americanus	0.1	-
	Raja sp.	-	0.1
Sta. 5-22	Arctica islandica (empty shells)		2.3
	Placopecten magellanicus		0.4
	Placopecten magellanicus (empty shells)		0.6
	Asteroidea		0.1
	Leptasterias tenera		5.1
Sta. 5-25	Porifera	0.1	-
	Hydroid colonies	0.3	0.4
	Arctica islandica (empty shells)	15.9	17.4
	Placopecten magellanicus	0.1	-
	Placopecten magellanicus (empty shells)	0.1	-
	Asteroidea	-	0.4

TABLE 16. (Continued)

		M-5	M-6
	Leptasterias tenera	7.6	3.8
	Flounder	0.1	0.1
	Macrozoarces americanus	0.1	-
	Ophichthus cruentifer	0.1	-
	Urophycis sp.	0.1	-
	Raja sp.	0.1	-
Sta. 5-28	Hydroid colonies		0.1
	Arctica islandica (empty shells)		8.3
	Placopecten magellanicus		0.2
	Leptasterias tenera		3.4
	Raja sp.		0.1
Sta. 5-29	Hydroid colonies	0.1	-
	Arctica islandica (empty shells)	+	+
	Placopecten magellanicus	0.1	-
	Placopecten magallenicus (empty shells)	-	0.1
	Cancer sp.	-	0.1
	Asteroidea	-	1.3
	Leptasterias tenera	1.7	0.6
	Macrozoarces americanus	0.1	-
	Ophichthus cruentifer	0.1	-
	Urophycis sp.	0.1	-

+ indicates a thick cover, density impossible to estimate accurately.

5.7 Epifaunal Samples

The Rocking Chair Dredge was used with moderate success on Cruises M5 through M8 to collect specimens of Arctica islandica for chemical analysis. None of these specimens were retained as voucher specimens.

Several species of fish were obtained with the otter trawl used on Cruises M5 through M8, and representatives of these were retained as voucher specimens.

Appendix B is a list of all species retained as voucher specimens from dredge and/or trawl collections made on Cruises M2 through M8.

5.8 CHN Analysis

5.8.1 Verification of Analytical Precision and Accuracy

Data from five replicate samples of National Bureau of Standards Reference Material analyzed by W.H.O.I. were compared for accuracy using a two-tailed Student's t-test. No significant differences were noted between NBS carbon values and W.H.O.I. measurements.

Fifteen Year 1 samples previously analyzed at W.H.O.I. were verified by the U.S.G.S. laboratory in Reston, Virginia. No significant differences between total carbon values as measured by the two laboratories were reported.

5.8.2 Year 2 Data

The raw data developed as a result of CHN analyses at regional and primary site-specific stations for Year 2 sampling cruises (M5 through M8) are given in Appendix D. As a result of the acid leaching procedure used on all Year 2 CHN samples, the carbon data presented are total organic carbon values rather than the total carbon (organic and inorganic) values presented in Year 1. Although acid leaching can result in systematically low carbon values due to loss of acid-soluble organic carbon during carbonate dissolution (Heath et al., 1977; Roberts et al., 1973), the fraction of organic carbon soluble in acid is dependent on the percent $CaCO_3$, and in samples containing less

than 10 percent $CaCO_3$, the percent soluble organic carbon/percent organic carbon is less than 0.1 (Froelich, 1980). Because the total carbon measured in Georges Bank samples from M2 through M4 ranged from 0.2 to 1.27 percent, no compensation for soluble organic carbon was made in acid treated samples.

The highest values of percent carbon for all Year 2 cruises were recorded at Regional Stations 13A ($\bar{x} = 1.9550 \pm 2.0750$) and 14A ($\bar{x} = 1.7600 \pm 2.0183$). Mean carbon values at these two stations were significantly higher than those of all other stations for all cruises as determined by a one-way analysis of variance (ANOVA) and Student-Newman-Keuls test. Other stations at which significantly high percent carbon was found included Regional Stations 3, 7A and 13.

5.9 Sediment Grain Size Analysis

Appendix F contains data on the sediment grain size composition of all stations for cruises M2 through M7. These parameters were used in the statistical correlations with faunal similarity indices cited above.

5.10 Hydrography

Appendix G contains data on surface and bottom temperatures (Table G-1) taken from the XBT recordings during each cruise, dissolved oxygen (Tables G-2 and G-3), and surface and bottom salinity (Table G-4). Dissolved oxygen values recorded for Cruises M5 and M6 were obtained via Winkler titration; beginning on Cruise M7, both a Winkler titration and electronic oxygen probe were used to obtain data. With only a few exceptions on Cruise M8, the values obtained by the Winkler method were higher than those obtained with the probe. No consistent pattern of differences was obtained, however.

6. DISCUSSION

6.1 Integration of Biological and Chemical Observations

6.1.1 Drilling Discharges to Georges Bank

Exploratory drilling started in Block 410 near Regional Station 16 in July, 1981, shortly after Cruise M1 and continued intermittantly until March 31, 1982. Exploratory drilling started in Block 312, the location of the site-specific array, on December 8, 1981, shortly after Cruise M2 and continued until June, 1982, shortly before Cruise M5.

The total amounts of drilling fluid solids used to drill the wells in Blocks 410 and 312 were 1,193.6 and 1,524.0 metric tons, respectively (E.P. Danenberger, MMS, personal communication). The muds contained 510 and 1,083 metric tons, respectively, of barium sulfate (barite). In addition, approximately 16,200 liters of diesel fuel were used in the drilling fluids in Block 312 to aid lubrication and to free stuck pipe. As much as 50 percent of the drilling mud for each well could have been either left in the hole or lost to permeable formations.

It is estimated that approximately 600 metric tons of drilling fluid solids containing 250 tons of barite were discharged from the rig in Block 410 and approximately 750 tons of drilling fluid solids containing 500 tons of barite were discharged from the rig in Block 312. Payne et al. (1982, 1983) estimated that approximately 525 liters of diesel fuel were discharged with the drilling fluids from the rig in Block 312. Several samples of drilling fluid collected at different times during drilling in Block 312 contained 23-1,130 mg/liter (ppm) total hydrocarbons (Payne et al., 1982). Approximately 1,200 metric tons of drill cuttings were discharged during drilling of each of these two exploratory wells.

A total of eight exploratory wells were drilled in the Lease Offering 42 area during 1981-1982. Neff (1983) estimated that a total of approximately 9,200 metric tons of drill cuttings and approximately 5,000 metric tons of drilling fluid solids containing 3,000 tons of barite and 1,500 tons of bentonite clay were discharged to Georges Bank during 1981-1982. By comparison, the rate of deposition of fine-grained sediments in the Mud Patch (in the vicinity of Regional Stations 13 and 13A), which is considered a major

site of deposition of fine-grained sediments swept off of Georges Bank (Twichell et al., 1981; Bothner et al., 1981), is about 84 million metric tons per year (Neff, 1983).

6.1.2 Block 410

The concentrations of barium, other metals, and hydrocarbons in bulk sediments from the upstream regional reference stations (Stations 1-3) did not change significantly during the two years of the monitoring program (Bothner et al., 1983; Payne et al., 1983).

At Station 16, located within 200 meters of the drilling rig in Block 410, the concentration of barium in the upper two centimeters of bulk sediment increased by a factor of 5.9 (from 32 to 189 ppm) between the first and sixth cruises (Bothner et al., 1983). The excess barium, presumably derived from drilling fluid solids, was very unevenly distributed in the sediments near the rig site. Mean concentrations of barium in bulk sediments from Station 16 decreased by Cruises M7 and M8. No drilling related changes in the concentrations of other metals, including chromium, were observed in bulk sediments from Station 16 during the two years of the monitoring program. The concentration of chromium in the fine sediment fraction increased slightly at Station 16 in an apparent response to drilling, but decreased to background concentrations by M4 (Bothner et al., 1983:15-16). Drill cuttings also were detected in the gravel fraction of sediments from Station 16. Much smaller increases in the concentration of barium were noted in bulk sediment samples from Stations 17 and 18 located 2,000 meters east and west, respectively, of the rig site, and no increases in other metals in either bulk or fine sediments were detected.

No biological effects attributable to deposition of discharged drilling fluids and cuttings have been observed at the Block 410 stations. At Station 16, the average number of individuals per 0.04 m^2 was lowest on Cruises M1 (before drilling began) and M2 (average of 158.5 and 145.4 individuals/0.04 m^2, respectively) and then rose to a range of averages of 213.8 to 346.8 individuals/0.04 m^2 on Cruises M3 through M8. These fluctuations apparently represent natural variation.

Changes over the eight sampling cruises in the total number of species and in the Shannon-Wiener diversity index were not significant. The total number of species

ranged from 96 (M3) to 127 (M5) and Shannon-Wiener diversity ranged from 4.88 (M3) to 5.42 (M1). Measures of faunal similarity (i.e. NESS and percent similarity) indicate a continuing high level of similarity between the rig site Station 16 and Station 17, the upcurrent reference station. Station 18, the downcurrent reference station, has had a somewhat different faunal composition than that seen at Stations 16 and 17 throughout the course of this investigation. The population of Ampelisca agassizi, a dominant at Station 18, has been present in comparable densities from M1 through M8, with average densities in Year 2 (M5-M8) somewhat higher than those in Year 1 (M1-M4).

6.1.3 Block 312

In the site-specific array of stations in Block 312, the concentration of barium in bulk surficial sediments from several stations around the rig site and especially to the west of it, increased during drilling (Bothner et al., 1983). The largest increase (approximately 4.7-fold from 28 ppm on Cruise M1 to 131.6 ppm on Cruise M5 shortly after drilling was completed) occurred at Station 5-1 approximately 200 meters from the rig site (Figure 81). Other site-specific stations where there was a large increase in barium concentration in bulk surficial sediments during drilling include Stations 5-2, 5-4, 5-8, and 5-12. At these stations, there was a trend for mean sediment barium concentrations to decrease and for the distribution of incremental barium concentrations to become more heterogeneous between Cruises M5 and M8. Drill cuttings were detected in the gravel fraction of sediments from Station 5-1.

The concentration of barium in the fine fraction of sediments (finer than 60 microns) increased much more during and after drilling than barium concentrations in bulk sediments. The concentration of chromium also increased in this fraction of sediments from stations near the rig site in Block 312. Based on barium concentration in the fine fraction of sediments from a few stations, Bothner et al. (1983) were able to detect transport and deposition of drilling fluid solids up to 65 km to the west (Station 12) of the drilling site in Block 312, and could account for an estimated 69 percent of the total barite discharged to the Bank during the drilling of the eight wells. Bothner et al. (1983) estimated that the half-time for the retention of discharged barite within 6 km of the drilling site in Block 312 is 4.8 months.

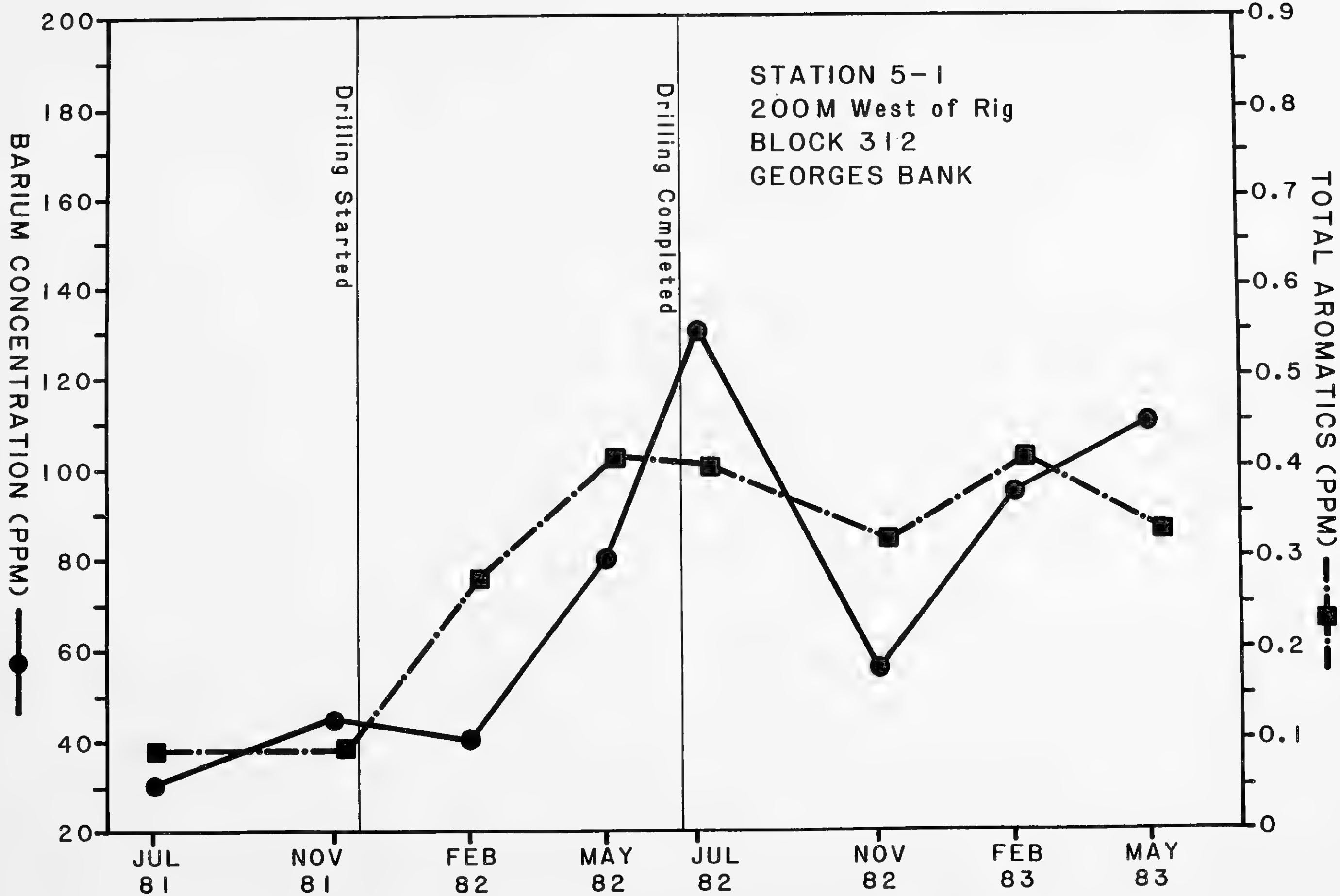


FIGURE 81. BARIUM CONCENTRATION AND TOTAL AROMATICS AT STATION 5-1 FOR EIGHT SAMPLING OCCASIONS. AROMATIC HYDROCARBON VALUES FOR FIRST FOUR CRUISES ARE BASED ON A SINGLE ANALYSIS OF A POOLED SAMPLE OF THREE REPLICATES. OTHER DATA POINTS ARE THE AVERAGE OF THREE REPLICATE SAMPLES. (BARIUM DATA FROM BOTHNER ET AL., 1983; HYDROCARBON DATA FROM PAYNE ET AL., 1983).

Payne et al. (1983) reported a slight, but statistically significant, increase in the concentration of aromatic hydrocarbons (as analyzed by UV fluorescence) in sediments at Station 5-1 during drilling (Figure 81). Dimethylnaphthalene and methyl phenanthrenes, but not other polycyclic aromatic hydrocarbons, were detected in quantifiable concentrations by GC/MS in these samples. The increase was small, from a predrilling concentration of 0.007 to 0.102 ppm total aromatics to a range of 0.097 to 0.572 ppm after drilling. These concentrations of low-medium molecular weight aromatic hydrocarbons in marine sediments are not considered toxic to benthic organisms (Neff and Anderson, 1981). A smaller but statistically significant increase in sediment aromatic hydrocarbon concentration also occurred at Station 5-18, 2 km west of the rig site, from a predrilling range of 0.047 to 0.159 ppm to a post-drilling range of 0.042 to 0.250 ppm. It is uncertain whether these increments in sediment hydrocarbon concentrations near and downcurrent from the rig site were derived from discharged drilling fluids containing diesel fuel or from another source, but they do seem to be correlated with the drilling activity.

No biological impacts attributable to drilling have been detected at the site-specific stations. During drilling, from December, 1981 to June, 1982, there was an increase in the average number of individuals per $0.04m^2$ and in the total number of species at Station 5-1 (Figure 82). The Shannon-Wiener diversity remained relatively constant. A similar but much less marked pattern of increasing numbers of individuals and species was observed between November, 1982 (M6) and May, 1983 (M8), almost a year after drilling was completed. Thus, these changes probably represent seasonal fluctuation in the benthic community of the region and not impacts of drilling discharges. The other primary site-specific stations exhibited a somewhat similar pattern. In most cases, the number of individuals per $0.04m^2$ was lowest in November, 1981 (M2), shortly before drilling began, for stations within 1 km of the drill site, or February, 1982 (M3) for stations more than 1 km from the drill site. With few exceptions, species abundance was lowest in November, 1981 (M2). There was an increase in the number of individuals and number of species at nearly all primary site-specific stations between February, 1982 and July, 1982, during which time drilling was taking place in Block 312. Those species which showed the most marked declines in abundance in November 1981 or February 1982, such as the amphipods Erichthonius rubricornis or Unciola inermis, showed substantial recovery

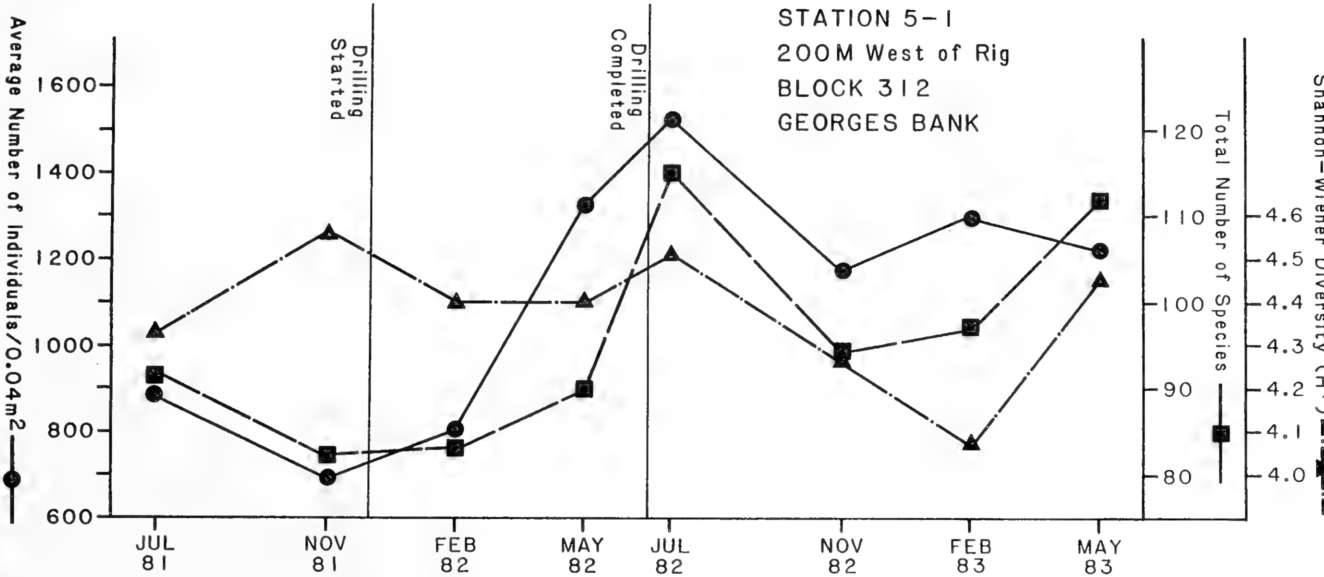


FIGURE 82. SHANNON-WIENER DIVERSITY AND TOTAL NUMBER OF SPECIES PER 0.24 m^2 (6 COMBINED REPLICATES), AND AVERAGE NUMBER OF INDIVIDUALS PER 0.04 m^2 AT STATION 5-1 FOR EIGHT SAMPLING OCCASIONS.

by May or July, 1982. Changes in the population density of E. rubricornis showed a high correlation with the sediment grain-size composition, changes in which were attributable to natural effects such as storms and bottom currents, rather than drilling operations.

6.1.4 Other Stations

Concentrations of barium (240-290 ppm) and hydrocarbons (1.0-2.5 ppm) were higher at Regional Stations 7A, 13, and 13A than at other stations (Bothner et al., 1983; Payne et al., 1983). However, these concentrations did not change significantly during and after drilling, indicating that they were derived from sources other than drilling discharges. Stations 7A and 13A were sampled only after drilling in Blocks 312 and 410 was complete, although drilling continued in four other blocks in Lease Area 42 until August-September, 1982. There were no obvious trends in benthic community parameters at these stations, although both number of individuals and number of species increased slightly between July (M5) and November (M6), 1982. At Station 13, the pattern of increasing density over the first three sampling seasons, followed by a sharp decline in the fourth, was not repeated in Year 2. Although there was a clear recovery, with almost a four-fold increase in the average number of individuals from M4 to M5, this was followed by a gradual decline. This general pattern was repeated by several individual species. The reason for the low M4 densities is not clear, but may represent a long-term trend with a greater than annual cycle. Overall, there were no changes in benthic community parameters that could be attributed to drilling activities.

6.2 Comparison With the Georges Bank Historical Study

The New England OCS Benchmark Study was initiated in 1977 by the Department of the Interior, Bureau of Land Management (now the Minerals Management Service) to provide a basis for assessing the effects of offshore oil and gas exploration and production. Forty-two stations on Georges Bank were sampled quarterly before the program was terminated in March of 1978. At that time, samples had been analyzed from only two of the four sampling periods, but results of the benthic infaunal analyses were not included in the Draft Final Report because of financial constraints on the program

participants. Two papers published later dealt with the polychaetes (Maurer and Leathem, 1980, 1981).

When the present Monitoring Program was established in 1981, eleven stations coincided with those sampled during the earlier study (Table 17). Taxon, Inc. was contracted to complete analysis of samples collected on the third and fourth cruises of the Benchmark Study and to analyze all data from those eleven stations which coincided with Monitoring Program Stations. These data provide information on seasonal variation, and provide a long term base for comparison with data generated on the current monitoring program. A final report on the Georges Bank Benthic Infauna Historical Study was submitted in March, 1983 (Michael et al., 1983).

Dominant species reported by Michael et al. (1983) at the eleven corresponding stations generally agree with the dominant species reported here, with at least four reported in common by both studies for most stations. There was particularly good correspondence for dominant species recorded at the Block 312 drilling site, Station 5-1, with seven species reported in common.

Some differences can be explained by differences in taxonomic designations: for example, Michael et al.'s (1983) Euclymene collaris is our Euclymene new sp. A. Specimens collected during both studies have been compared, and they are in fact the same species, which we believe to be undescribed. Similarly, the authors use the older names Exogone brevicornis (a polychaete), Trichophoxus epistomus (an amphipod) and Leptochelia savigny (a tanaid) for Exogone verugera, Rhepoxynius hudsoni, and Tanaissus lilljeborji, respectively. Some higher taxa reported by Michael et al. (1983) are speciated in our data, including Archiannelida, Oligochaeta and bipalpate Cirratulidae. Some parallels between the two studies can be implied for these taxa. For instance, Michael et al. (1983) reported Oligochaeta as dominant at the Mud Patch (Historical Station 6), while we have recorded Tubificoides new sp. A at our corresponding Station 13. In other cases, translation between studies is not clear. Thus, the ampharetid polychaete Eclysippe new sp. A is a dominant at our Station 7, while Michael et al. (1983) report another ampharetid, Anobothrus gracilis as a dominant at the corresponding station (Station 23). A direct comparison of the specimens in question must be made before it is clear whether we are referring to the same species. The different sieve size used in the studies may also have contributed to the differences in species reported as dominants. The 0.3 mm

TABLE 17. RELATIONSHIP BETWEEN GEORGES BANK MONITORING STATIONS AND NEW ENGLAND OCS BENCHMARK STATIONS.

Georges Bank Monitoring Stations	Benchmark Stations
1	-
2	29
3	28
4	11
5 (rig site)	20 (Near 5)
6	19
7	23
8	25
9	-
10	-
11	-
12	8
13	6 (Near 13)
14	40
15	37
16	-
17	-
18	-

screen retains not only more individuals, including juveniles, of those species found on the 0.5 mm screen, but also retains small-bodied species which are not present at all, or only rarely, on the larger screens. The dominant species reported at Stations 16 and 17, Paradoneis new sp. A, is such a species. Over 95 percent of all individuals collected were found on the 0.3 mm screen.

Average densities, extrapolated for comparison to density per square meter, were generally higher in the present study than in the Historical Study, even when only the 0.5 mm fractions are compared (Table 18). Densities recorded in the present study were often two or three times the average densities recorded in the Historical Study. These differences may be due to dramatic natural differences between years (1977-78 vs. 1981-82 or 1982-83), since some differences of the same magnitude occur between Year 1 and Year 2 of the present study (e.g., Station 2, Table 18).

While the cruises of the two studies occurred in similar months, the density patterns of the same species at the same stations did not fluctuate similarly between the two studies. At the Historical Study Station 20, Exogone hebes was most abundant in fall and winter, while in the current study E. hebes at the corresponding station (Station 5-1) was most abundant in the spring in Year 1 (M4) and in the summer in Year 2 (M5). At the Historical Study's Station 29, densities of E. hebes did not vary much among winter, summer and spring but were quite low in the fall, whereas at the corresponding Station 2 in the present study, E. hebes did not vary much at all in abundance throughout Year 1. Differences between annual density patterns in Exogone verugera, Euclymene sp. A and Erichthonius rubricornis also exist at Station 5-1. For any particular species, population density patterns vary among seasons, years and stations and differences are due probably not just to recruitment differences but also differential mortality and mobility.

6.3 Comparison of Year 1 and Year 2 Results

Results presented in this report incorporate data generated during two full years of monitoring on Georges Bank in an effort to assess potential biological impacts of drilling activities. To date, eight dry holes have been drilled on the Bank, and no biological impacts which can be attributed to drilling have been detected.

TABLE 18. COMPARISON OF AVERAGE FAUNAL DENSITIES PER SQUARE METER REPORTED IN THE HISTORICAL STUDY AND THE MONITORING PROGRAM (MP). RESULTS USED FOR BOTH STUDIES ARE BASED ON RETENTION ON THE 0.5 mm SCREEN ONLY.

Station	MP (Year 1)	MP (Year 2)	Historical Study
2	6,450	11,494	7,400
3	6,425	9,969	5,050
4	8,925	16,175*	10,900
5	15,300	22,038	7,550
6	14,050	11,956	6,000
7	7,000	**	7,300
8	6,788	6,869	3,900
12	19,075	20,250*	8,700
13	23,756	34,000	4,700
15	4,738	**	2,450

* Data not available from February cruise.
** Not sampled in Year 2.

Analysis of bottom photographs and benthic infaunal samples collected during Year 2 (M5 through M8) produced results which confirmed conclusions reached at the end of Year 1 (M1 through M4) concerning patterns of benthic community structure. That is, the community at any particular regional station was distinct from that found at any other station, and stations grouped consistently by depth and sediment type. For example, the eight seasonal samples collected at Regional Station 1, at 60 m depth, were more similar to each other than to samples from any other station. Station 1 was then most similar to Stations 4 and 10, also located along the 60 m isobath.

The pattern seen during Year 1 at the site-specific station array around Station 5 was repeated in Year 2: while most stations within the array had a homogeneous community structure, species composition was different at the two western most stations in the array. This difference was correlated with an increase in the proportion of fine sand at these two stations.

Patterns of fluctuation in the population densities of particular annelid or amphipod species in Year 2 were similar but not identical to those seen in Year 1. While average densities of total individuals were generally higher at most stations in Year 2 than in Year 1, some species such as Unciola inermis, Parapionosyllis longicirrata, Sphaerosyllis cf. brevifrons and Exogone verugera showed wide fluctuations in density over time while others exhibited very stable population levels. The sharp decline seen in nearly all species at Station 13 in the spring samples (M4) in Year 1 was not seen in the corresponding samples (M8) in Year 2.

6.4 Tasks Added in Year 2

One of the three new tasks added in Year 2 dealt with the analysis of historic infaunal samples collected at U.S.G.S. Station A. Results show that Station A is most similar to Regional Station 6, although Station A is at 85 m and Station 6 is at 100 m. The benthic community at Station A changed very little over the two years (1980-82) of sampling, despite the high probability of winter storms documented in preceding years (Butman and Moody, 1983). Butman (1982) found that a biological mat on the sediment surface apparent in photographs "armors" sediments during the summer months from erosion by currents that produce sediment resuspension in the winter. Our results on the

macrofaunal populations indicate that either the activities of the macrofauna in secreting sediment-binding materials is different during the winter or the biological mat consists mainly of microorganisms. The lack of fluctuation in the community structure at Station A, however, corresponds well to the results obtained at the Monitoring Program stations.

Results from the life-history task, also a new component in Year 2, aid in interpreting seasonal changes in species abundance. During the period of drilling at Block 312, the average number of individuals increased from M2 to M5 (Figure 82). Table 6 lists the dominant species at Station 5-1 which were primarily responsible for this increase. The summary in Table 12 indicates that for many of these dominant species, recruitment occurred from May to July; thus the increase in average number of individuals may be accounted for by recruitment.

Life history analysis can similarly be used to explain variation in numbers of individual species. The observation that Unciola inermis is an annual species with some recruitment in May (Figure 66), explains the variation in U. inermis numbers in Figure 32. Peak abundance occurred in May 1982 (M4) and May 1983 (M8); abundance declined during the rest of the year due to mortality. Similarly, the polychaete Cossura longocirrata at Station 13 exhibited a marked decline in abundance in February (Figure 28). Life history data indicated that spawnings occurred at that time followed by recruitment.

In contrast, Exogone verugera increased steadily in abundance at Station 5-1 from a low in November 1981 to a high in July 1982 (Figure 36). Juveniles, however, were only observed with females in winter (February, 1982). Hence, the observed recruitment pattern does not account for the greatly increased density in July, 1982. Other factors such as adult migration from adjacent areas may be important in regulating population size in any one location.

Erichthonius rubricornis appears to be a semi-annual species with maximum recruitment during November and May (Figure 67). However, variation in E. rubricornis numbers cannot easily be correlated with the timing of recruitment. Lack of correlation may be due to the patchy distribution of this species. Length-frequency distributions for M5-M8 should help in interpreting the variation in numbers during those cruises.

Ampelisca agassizi is an annual species with recruitment occurring during November to February (Figure 68); this explains the variation in numbers shown in Figure

24. Average number of individuals increased during cruises M2-M3 and M6-M7 due to recruitment and decreased during the rest of the year due to mortality.

The third new task added in Year 2 addressed the relationship of benthic productivity and the diet of an important demersal fish species. The yellowtail flounder was analyzed during the past year. The main prey of yellowtail flounder are animals living on or near the sediment surface. At Stations 5 and 13, the diet was mostly comprised of benthic macrofaunal species; at Station 10 pelagic prey were also important. While the dominant prey species vary seasonally and between stations, in each case, one or two species constituted the bulk of the diet.

For a given prey species, electivity indices were consistent between stations. For many prey species (Figures 70-72) electivity indices did not change much seasonally, implying that flounder feeding changes in proportion to changes in benthic abundance.

In the case of dominant amphipods, electivity appeared to vary inversely with abundance. Comparing Figure 70 to Figure 32 for Unciola inermis and Figure 70 to Figures 39-40 for Erichthonius rubricornis, electivity varies inversely with abundance at Station 5-1 from M5 to M8. Similarly, comparing Figure 72 to Figure 25 for Ampelisca agassizi, electivity is lowest when abundance is highest (M7). There are several possible explanations for this apparent relationship; size-selective predation is one which will be investigated in Year 3.

The observation that the numerically dominant amphipods are also dominant prey species at Stations 5 and 13 implies that flounder feeding must be closely linked to benthic production. In Year 3 of this task, the nature of this linkage will be further investigated by quantifying the rates of fish consumption and benthic production.

As a result of the new studies on the life history of selected dominant species, the prey preference of a selected fish species, and analysis of historical benthic data, we are establishing a particularly strong data base on the benthic communities of Georges Bank. These new studies, taken together with the demonstrated stability of the currently monitored communities, provide the background necessary to detect, and perhaps eventually predict changes in benthic community structure and fish feeding and production as a result of oil and gas exploration activities on Georges Bank.

7. REFERENCES

Georges Bank Benthic Infauna Monitoring Program. Final Report, Year 1 to USDI, Minerals Management Service, Washington, D.C. Battelle and Woods Hole Oceanographic Institution, 1983.

Boesch, D.F. 1977. Application of numerical classification in ecological investigations of water pollution. U.S. Department of Commerce, NTIS PB-269 604. EPA-600/3-77-033. 114 pp.

Bolderac, R. 1979. Formalin-agar for embedding small tissue specimens. Lab. Medicine 10(12):766.

Bothner, M.H., R.R. Rendigs, E. Campbell, M.W. Doughten, P.J. Aruscavage, A.F. Dorrzapf, Jr., R.G. Johnson, C.M. Parmenter, M.J. Pickering, D.C. Brewster and F.W. Brown. 1982. The Georges Bank Monitoring Program. Analysis of Trace Metals in Bottom Sediments. First Year Final Report to U.S.D.I., Minerals Management Service, Washington, D.C. U.S. Department of the Interior, Geological Survey, Woods Hole, MA.

Bothner, M.H., R.R. Rendigs, E. Campbell, M.W. Doughten, C.M. Parmenter, J.J. Pickering, R.G. Johnson and J.R. Gillison. 1983. The Georges Bank Monitoring Program: Analysis of Trace Metals in Bottom Sediments During the Second Year of Monitoring. Final Report to U.S.D.I., Minerals Management Service, Washington, D.C. U.S. Department of the Interior, Geological Survey, Woods Hole, MA.

Bothner, M.H., E.C. Spiker, P.P. Johnson, R.R. Rendigs and P.J. Aruscavage. 1981. Geochemical evidence for modern sediment accumulation on the Continental Shelf off Southern New England. J. Sediment. Petrol. 51:281-292.

Bousfield, E.L. 1973. Shallow-water Gammaridean Amphipoda of New England. Cornell Univ. Press. 312 pp.

Butman, B. 1982. Currents and Sediment Movement on Georges Bank. pp. 31-61 In: Georges Bank Past, Present and Future of a Marine Environment. G. McLeod and J.H. Prescott (Eds.). Westview Press. Boulder, CO.

Butman, B., M.A. Noble, J.A. Moody and M.H. Bothner. 1983. Lydonia Canyon Dynamics Experiment: Preliminary Results. Chapter 8 (pp. 8-1 to 8-93) In: Final Report to U.S. Bureau of Land Management. Environmental Geologic Studies on the United States Mid- and North Atlantic Outer Continental Shelf Area, 1980-1982, Vol. III. North Atlantic Region. Edited by Bonnie A. McGregor, U.S. Dept. of Interior Geological Survey.

Butman, B. and J.A. Moody. 1983. Observation of Bottom Currents and Sediment Movement along the U.S. East Coast Continental Shelf during winter. Chapter 7 (pp. 7-1 to 7-58) In: Final Report to U.S. Bureau of Land Management. Environmental Geologic Studies on the United States Mid- and North Atlantic Outer Continental Shelf Area, 1980-1982. Vol. III. North Atlantic Region. Edited by Bonnie A. McGregor, U.S. Dept. of Interior Geological Survey.

Froelich, P.N. 1980. Analysis of organic carbon in marine sediment. Limnol. Oceanogr. 25(3):564-572.

Garwood, P.R. 1982. The life-cycle and population dynamics of Streptosyllis websteri (Polychaeta:Syllidae) from a Northumberland Beach. J. mar. biol. Ass. U.K., 62:783-798.

Gibbs, R.J. 1977. Effect of combustion temperature and time, and of the oxidation agent used in organic carbon and nitrogen analyses of sediments and dissolved organic material. J. Sediment. Petrol. 47(2):547-550.

Gibbs, R.J. 1974. A settling tube system for sand-size analysis. J. Sed. Petrol. 44(2):583-588.

Grassle, J.F. and W.L. Smith. 1976. A similarity measure sensitive to the contribution of rare species and its use in investigation of variation in marine benthic communities. Oecologia 25:13-22.

Heath, R.T., T.C. Moore and J.P. Dauphin. 1977. Organic carbon in deep-sea sediments. In: N.R. Anderson and A. Malahoff (Eds.), The Fate of Fossil Fuel CO_2 in the Oceans. Plenum.

Hull, C.H. and N.H. Nie. 1981. SPSS Update 7-9: New Procedures and Facilities for Released 7-9. McGraw-Hill, New York. 402 pp.

Hurlbert, S.H. 1971. The nonconcept of species diversity: a critique and alternative parameters. Ecology 52:577-586.

Ivlev, V.S. 1961. Experimental Ecology of the Feeding of Fish. Yale University Press, New Haven.

Langton, R.W. 1983. Food habits of yellowtail flounder, Limanda ferruginea (Storer), from off the Northeastern United States. Fisheries Bulletin 81:15-22.

Maurer, D. and W. Leathem. 1980b. Dominant species of polychaetous annelids of Georges Bank. Mar. Ecol. Prog. Ser. 3:135-144.

Maurer, D. and W. Leathem. 1981. Ecological distribution of polychaetous annelids from the New England Outer Continental Shelf, Georges Bank. Int. Rev. Ges. Hydrobiol. 66(4):505-528.

Michael, A.D., C.D. Long, D. Maurer and R.A. McGrath. 1983. Georges Bank Benthic Infauna Historical Study. Final Report to U.S.D.I., Minerals Management Service, Washington, D.C. 171 pp.

Möller, P. and R. Rosenberg. 1982. Production and abundance of the amphipod Corophium volulator on the west coast of Sweden. Netherlands Jour. Sea Res. 16:127-140.

Mills, E.L. 1967. The biology of an ampeliscid amphipod crustacean sibling species pair. Jour. Fish. Res. Bd. Canada. 24(2):305-355.

Neff, J.M. and J.W. Anderson. 1981. Response of Marine Animals to Petroleum and Specific Petroleum Hydrocarbons. Halsted Press, New York. 167 pp.

Neff, J.M. 1983. The Potential Impacts of Drilling Fluids and Other Effluents from Exploratory Drilling on the Living Resources. In: R.H. Backus (Ed.), Georges Bank: Text and Atlas, (in press).

Nie, N.H., C.H. Hull, J.G. Jenkins, K. Steinbrenner and D.H. Bent. 1975. Statistical Package for the Social Sciences. 2nd Ed. McGraw-Hill, New York. 675 pp.

Olive, P.J.W. and R.B. Clark. 1978. Physiology of Reproduction. pp. 271-368 In: P.J. Mill (Ed.), Physiology of Annelids. Academic Press, London.

Payne, J.R., J.L. Lambach, R.E. Jordan, G.D. McNabb, Jr., R.R. Sims, A. Abasumara, J.G. Sutton, D. Generro, S. Gagner and R.F. Shokes. 1982. Georges Bank Monitoring Program. Analysis of Hydrocarbons in Bottom Sediments and Analysis of Hydrocarbons and Trace Metals in Benthic Fauna. First Year Final Report to U.S.D.I., Minerals Management Service, Washington, D.C. Science Applications, Inc., LaJolla, CA.

Payne, J.R., J.L. Lambach, R.E. Jordan, C.R. Phillips, G.D. McNabb, Jr., M.K. Beckel, G.H. Farmer, R.R. Sims, Jr., J.G. Sutton, C. de Otiveria and A. Abusamura. 1983. Georges Bank Monitoring Program: Year Two. Analysis of Hydrocarbons in Bottom Sediments and Analysis of Hydrocarbons and Trace Metals in Benthic Fauna. Final Report to U.S.D.I., Minerals Management Service, Washington, D.C. Science Applications, Inc., LaJolla, CA.

Pocklington, P. and M.S. Hutcheson. 1983. New record of viviparity for the dominant benthic invertebrate Exogone hebes (Polychaeta:Syllidae) from the Grand Banks of Newfoundland. Mar. Ecol. Prog. Ser. 11(1):239-244.

Rasmussen, E. 1973. Systematics and ecology of the Isefjord Marine Fauna (Denmark) Ophelia. 11:1-495.

Roberts, A.A., J.G. Palacas and I.C. Frost. 1973. Determination of organic carbon in modern marine sediments. J. Sediment. Petrol. 43:1157-1159.

Sanders, H.L. 1968. Marine benthic diversity: a comparative study. American Naturalist. 102:243-282.

Schroeder, P.C. and C.O. Hermans. 1975. Annelida:Polychaeta. pp. 1-213 In: Giese, A.C. and J.S. Pearse (Eds.), Vol. 3. Reproduction of Marine Invertebrates. Annelids and Echiurans. Academic Press, Inc., New York.

Siegel, S. 1956. Nonparametric Statistics for the Behavioral Sciences. McGraw Hill. New York. 312 pp.

Smith, W.L. and J.F. Grassle. 1977. Sampling properties of a family of diversity measures. Biometrics 33:283-291.

Twichell, D.C., C.E. McClennen and B. Butman. 1981. Morphology and process associated with the accumulation of the fine-grained sediment deposit on the Southern New England Shelf. J. Sediment. Petrol. 51:269-280.

Williams, W.T. 1971. Principles of clustering. Ann. Rev. Ecol. Syst. 2:303-326.

APPENDIX A

APPENDIX A

SPECIES RECORDED FROM GEORGES BANK INFAUNAL SAMPLES

PORIFERA

Calcarea sp. A
Cliona vastifica Hancock, 1849
Isodictya deichmanae (de Laubenfels, 1949)
Leucosolenia cancellata Verrill, 1874
Lissondendryx isodatylis (Carter, 1882)
Microciona prolifera (Ellis & Solander, 1786)
Polymastia robusta Bowerbank, 1860
Suberites ficus (Johnson, 1842)
Subertitidae sp. A

CNIDARIA

HYDROZOA

Acaulis primarius Stimpson, 1854
Acryptolaria conferta Allman, 1877
Antenularia americana Nutting, 1900
Calycella syringa (L. 1767)
Calyptospadix cerulea Clark, 1882
Campanularia gigantea Hincks 1865
Campanularia abyssa Fraser, 1940
Campanularia groenlandica Levinsen, 1893
Campanularia angulata (Hincks, 1861)
Campanularia hinksi Alder, 1856
Campanularia verticillata (L., 1758)
Cladocarpus flexilis Verrill, 1883
Clytia coronata Clarke, 1879
Clytia cylindrica (Agassiz, 1862)
Clytia edwardsi (Nutting, 1901)
Corymorpha pendula Agassiz, 1862
Cuspidella costata Hincks, 1868
Cuspidella grandis Hincks, 1868
Dicoryne flexuosa Sars, 1873
Diphasia robusta Fraser, 1943
Diphasia rosacea (L., 1758)
Ectopleura prolifica Hargitt, 1908
Eucopella sp. A
Eudendrium dispar Agassizi, 1862
Eudendrium ramosum L., 1758
Eudendrium tenellum Allman, 1877
Garveia groenlandica Levinson, 1893
Halecium articulosum Clarke, 1875
Halecium flexile Allman, 1888
Halecium sp. A

Hydractinia echinata Fleming, 1828
Hydrallmania falcata (L., 1758)
Lovenella grandis Nutting, 1901
Lovenella sp. A
Monobrachium parasitum Mereschkowsky, 1877
Obelia commissaralis McCrady, 1858
Obelia dichotoma (L., 1758)
Obelia flabellata (Hincks, 1866)
Obelia hyalina Clarke, 1879
Obelia longissima (Pallas, 1766)
Opercularella lacerata (Johnston, 1847)
Opercularella pumilla Clark, 1875
Sertularella tenella (Alder, 1856)
Sertularella tricuspidata (Alder, 1856)
Stegopoma fastigiata (Alder, 1860)
Stegopoma plicatile (Sars, 1862)
Stylactis hooperi Sigerfoos, 1899
Thuiaria argentea (L., 1758)
Thuiaria carica Levensen, 1893
Thuiaria cupressina (L., 1758)
Thuiaria plumulifera Allman, 1877
Thuiaria similis (Clark, 1876)
Thuiaria tenera (Sars, 1873)
Tubularia couthouyi Agassiz, 1862
Tubularia indivisa L., 1767

ANTHOZOA

Alcyonium carneum Agassiz, 1850
Ceriantheopsis americanus Verrill, 1866
Desmophyllum cristagalli Milne Edwards and Haime, 1848
Edwardsia elegans Verrill, 1869
Edwardsia leidyi Verrill, 1898
Edwardsia sp. A, sp. B, sp. C
Epizoanthus americanus Verrill, 1864
Halcampidae sp. A
Hexactiniae sp. A, sp. B, sp. C, sp. D, sp. E, sp. F, sp. G, sp. H
Anthozoa sp. A, sp. B, sp. C, sp. D, sp. E, sp. F, sp. G, sp. H, sp. I, sp. J, sp. K

NEMERTEA

Heteronemertea

Cerebratulus lacteus (Leidy, 1851)
Cerebratulus luridus Verrill, 1873
Micrura albida Verrilli, 1879
Micrura sp. A
Lineus sp. A

Zygeupolia spp.
Nemertea sp. A,B,C,D,E,F,G,H,I,K,L,M,N,O,P,Q,R

Hoplonemertea

Monostylifera sp. A

ANNELIDA

OLIGOCHAETA

Tubificidae

Adelodrilus anisosetosus Cook, 1969
Adelodrilus multispinosus Erséus, 1979
Adelodrilus sp. A
Adelodrilus n. sp. B
Bathydrilus longus Erséus, 1979
Heterodrilus occidentalis Erséus, 1981
Peosidrilus biprostratus Baker and Erséus, 1979
Phallodrilus coeloprostratus Cook, 1969
Phallodrilus n. sp. A
Phallodrilus parviatriatus Cook, 1971
Phallodrilus tenuissimus Erséus, 1979
Tubifex pseudogaster (Dahl, 1960)
Tubificidae sp. F,G
Tubificoides apectinatus (Brinkhurst, 1965)
Tubificoides intermedius (Cook, 1969)
Tubificoides n. sp. A
Uniporodrilus n. sp. A

Enchytraeidae

Grania n. sp. A
Grania n. sp. B
Grania n. sp. C
Marionina welchi Lasserre, 1971

Oligochaeta n. fam. sp. A

HIRUDINEA

Hirudinea sp. A

POLYCHAETA

Ampharetidae

Amage tumida Ehlers, 1887
Ampharete acutifrons (Grube, 1860)
Ampharete arctica Malmgren, 1866

Ampharete sp. B
Amphicteis gunneri (Sars, 1835)
Anobothrus gracilis (Malmgren, 1866)
Asabellides sp. A
Eclysippe sp. A
Lysippe labiata Malmgren, 1865
Lysippe sp. A
Melinna elisabethae McIntosh, 1922
Sabellides borealis Sars, 1851
Samytha sexcirrata (Sars, 1856)
Samythella sp. A
Ampharetidae, n. gen., n. sp. A
Ampharetidae, n. gen., n. sp. B
Ampharetidae, n. gen., n. sp. C
Ampharetidae, n. gen., n. sp. D

Amphinomidae

Paramphinome jeffreysii (McIntosh, 1868)

Aphroditidae

Aphrodita hastata Moore, 1905
Laetmonice filicornis Kinberg, 1855

Apistobranchidae

Apistobranchus tullbergi (Theél, 1879)

Arabellidae

Arabella sp. A
Drilognathus sp. A
Drilonereis longa Webster, 1879
Drilonereis magna Webster & Benedict, 1887
Drilonereis new sp. A (free-living)
Drilonereis new sp. B (parasitic with Aricidea catherinae)
Drilonereis new sp. C (parasitic with paraonid)
Drilonereis new sp. D (parasitic with cirratulid)

Capitellidae

Barantolla sp. A
Capitella spp. (includes C. capitata)
Capitella jonesi (Hartman, 1959)
Heteromastus filiformis (Claparède, 1864)
Mediomastus fragilis Rasmussen, 1973
Notomastus latericeus Sars, 1850

Chaetopteridae

Spiochaetopterus oculatus Webster, 1879

Chrysopetalidae

Dysponetus gracilis Hartman, 1965

Cirratulidae

Caulleriella n. sp. B
Caulleriella n. sp. C
Chaetozone n. sp. A
Chaetozone n. sp. B
Cirratulus cirratus (Müller, 1776)
Dodecaceria n. sp. A
Tharyx acutus Webster & Benedict, 1887
Tharyx annulosus Hartman, 1965
Tharyx dorsobranchialis Kirkegaard, 1959
Tharyx marioni (Saint-Joseph, 1894)
Tharyx nr. *monilaris* Hartman, 1960
Tharyx n. sp. A
Tharyx sp. C
Tharyx sp. D
Tharyx sp. E
Tharyx sp. F

Cossuridae

Cossura longocirrata Webster & Benedict, 1887

Ctenodrilidae

Ctenodrilus serratus (Schmidt, 1857)

Dorvilleidae

Dorvillea sociabilis (Webster, 1879)
Dorvillea sp. A
Dorvilleidae sp. A
Ophryotrocha sp. A
Ophryotrocha sp. B
Protodorvillea gaspeensis Pettibone, 1961
Protodorvillea kefersteini (McIntosh, 1869)
Protodorvillea minuta (Hartman, 1965)

Schistomeringos caeca (Webster & Benedict, 1884)
Schistomeringos sp. C

Eunicidae

Eunice attenata (Savigny, 1820)
Eunice norvegica (L., 1767)
Eunice pennata (Müller, 1776)
Eunice vittata (delle Chiaje, 1828)
Lysidice ninetta Audouin & Milne Edwards, 1833
Marphysa belli (Audouin & Milne Edwards, 1833)
Marphysa sanguinea (Montagu, 1815)
Marphysa stylobranchiata Moore, 1909
Nematonereis unicornis (Grube, 1840)

Euphrosinidae

Euphrosine armadillo Sars, 1851

Flabelligeridae

Brada villosa (Rathke, 1843)
cf. Flabelligera affinis Sars, 1829
Flabelligera cf. cirrifera Hartman & Fauchald, 1971
Flabelligera sp. B
Flabelligera sp. C
Flabelligeridae sp. A
Pherusa nr. falcata (Støp-Bowitz, 1947)
Pherusa plumosa (Müller, 1776)
Pherusa sp. A

Glyceridae

Glycera capitata Oersted, 1843
Glycera dibranchiata Ehlers, 1868
Glycera robusta Ehlers, 1868
Glycera n. sp. A

Goniadidae

Goniada maculata Oersted, 1843
Goniada norvegica Oersted, 1845
Goniada n. sp. A
Goniadella gracilis (Verrill, 1873)
Goniadidae, n. gen., n. sp. A

Hesionidae

Gyptis sp. A
Hesionidae, n. gen., n. sp. A
Microphthalmus listensis Westheide, 1967

Microphthalmus sczelkowii Mecznikow, 1865
Microphthalmus sp. A
Neopodarke woodsholea Hartman, 1965
Nereimyra punctata (Müller, 1776)

Lumbrineridae

Lumbrinerides acuta (Verrill, 1875)
Lumbrineris fragilis (Müller, 1776)
Lumbrineris impatiens (Claparède, 1868)
Lumbrineris latreilli (Audouin & Milne-Edwards, 1833)
Lumbrineris paradoxa Saint-Joseph, 1888
Lumbrineris tenuis (Verrill, 1873)
Lumbrineris sp. B
Lumbrineris sp. C
Lumbrineris sp. D
Ninoe nigripes Verrill, 1873

Maldanidae

Asychis biceps (Sars, 1861)
Axiothella cf. catenata (Malmgren, 1865)
Axiothella sp. A
Axiothella sp. B
Clymenella torquata (Leidy, 1855)
Clymenella sp. A
Clymenura borealis (Arwidsson, 1907)
Clymenura polaris (Theél, 1879)
Clymenura sp. A
Euclymene sp. A
Euclymene sp. B
Euclymeninae sp. B
Heteroclymene robusta Arwidsson, 1907
Isocirrus planiceps (Sars, 1872)
Maldane sarsi Malmgren, 1865
Maldanella sp. A
Maldanidae sp. B
Maldanidae sp. C
Maldanidae sp. D
Maldanidae sp. E
Maldanidae sp. F
Maldanidae sp. G
Nicomache lumbricalis (Fabricius, 1780)
Notoproctus sp. A

Petaloproctus borealis Arwidsson, 1906
Petaloproctus tenuis Theél, 1879
Praxillella gracilis (Sars, 1861)
Praxillura longissima Arwidsson, 1907
Rhodine loveni Malmgren, 1865
Rhodine gracilior Tauber, 1879

Nephtyidae

Aglaophamus circinata (Verrill, 1874)
Nephtys bucera Ehlers, 1868
Nephtys caeca (Fabricius, 1780)
Nephtys incisa Malmgren, 1865
Nephtys paradoxa Malm, 1874
Nephtys picta Ehlers, 1868
Nephtys squamosa Ehlers, 1887
Nephtys sp. B
Nephtys sp. C

Nereididae

Ceratocephale loveni Malmgren, 1867
Nereis grayi Pettibone, 1956
Nereis pelagica (L., 1761)
Nereis cf. riisei Grube, 1856
Nereis zonata Malmgren, 1867
Nereis sp. B
Nereis sp. E
cf. Rullerinereis sp. A

Onuphidae

Mooreonuphis pallidula (Hartman, 1965)
Mooreonuphis sp. A
Nothria conchylega (Sars, 1835)
Onuphis opalina (Verrill, 1873)
Paronuphis sp. A
Rhamphobrachium sp. A
Rhamphobrachium sp. B

Opheliidae

Ophelia denticulata Verrill, 1875
Ophelia limacina (Rathke, 1843)
Ophelina abranchiata Støp-Bowitz, 1958

Ophelina acuminata Oersted, 1843
Ophelina cylindricaudata (Hansen, 1878)
Ophelina sp. A
Opheliidae sp. A
Travisia forbesi Johnson, 1840
Travisia sp. A

Orbiniidae

Leitoscoloplos acutus (Verrill, 1873)
Leitoscoloplos cf. fragilis (Verrill, 1873)
Leitoscoloplos robustus (Verrill, 1873)
Leitoscoloplos sp. A
Orbinia swani Pettibone, 1957
Scoloplos acmeceps Chamberlin, 1919
Scoloplos armiger (Müller, 1776)
Scoloplos (?Leodamas) sp. A
Phylo felix Kinberg, 1866

Oweniidae

Myriochele heeri Malmgren, 1867
Myriochele oculata Zaks, 1923
Myriochele sp. A
Myriowenia gosnoldi Hartman, 1965
Owenia fusiformis delle Chiaje, 1844

Paraonidae

Aricidia albatrossae Pettibone, 1957
Aricidia nr. belgica (Fauvel, 1936)
Aricidea catherinae Laubier, 1967
Aricidea cerruti Laubier, 1966
Aricidea nr. hartmani (Strelzov, 1968)
Aricidea longobranchiata Day, 1961
Aricidea neosuecica Hartman, 1965
Aricidea quadrilobata Webster & Benedict, 1887
Aricidea simplex (Day, 1963)
Aricidea suecica Eliason, 1920
Aricidea wassi Pettibone, 1965
Aricidea n. sp. A
Aricidea n. sp. B
Aricidea sp. C
Aricidea sp. D
Aricidea sp. E
Aricidea sp. F
Aricidea sp. G
Cirrophorus brevicirratus Strelzov, 1973
Cirrophorus furcatus (Hartman, 1957)

Levinsenia gracilis (Tauber, 1879)
Paradoneis n. sp. A
Paradoneis sp. B
Paradoneis lyra (Southern, 1914)
Paraonis fulgens (Levinsen, 1883)
Paraonis pygoenigmatica Jones, 1968
Paraonis n. sp. A
Paraonis sp. B
Paraonis sp. B_2
Paraonis n. sp. C
Paraonis sp. D

Pectinariidae

Pectinaria gouldi (Verrill, 1873)
Pectinaria granulata (L., 1767)
Pectinaria hyperborea (Malmgren, 1866)

Phyllodocidae

Cirrodoce cristata Hartman & Fauchald, 1971
Eteone longa (Fabricius, 1780)
Eteone spetsbergensis Malmgren, 1865
Eulalia bilineata (Johnston, 1840)
Eulalia viridis (L., 1767)
Eumida sanguinea (Oersted, 1843)
Genetyllis castanea (Marenzeller, 1879)
Hesionura elongata (Southern, 1914)
Mystides borealis borealis Theél, 1979
Mystides borealis caeca Langerhans, 1880
Mystides rarica (Ushakov, 1958)
Paranaitis speciosa (Webster, 1880)
Phyllodoce arenae Webster, 1879
Phyllodoce groenlandica Oersted, 1842
Phyllodoce maculata (L., 1767)
Phyllodoce mucosa Oersted, 1843
Phyllodoce sp. A
Phyllodoce sp. B
Phyllodocidae n. gen., sp. A

Pilargidae

Ancistrosyllis groenlandica McIntosh, 1879
Synelmis klatti (Friedrich, 1950)

Polygordidae

Polygordius sp. A
Polygordius sp. B

Polynoidae

Antinoana fusca Hartman & Fauchald, 1971
Eucranta villosa Malmgren, 1865
Harmothoe extenuata (Grube, 1840)
Lepidonotus squamatus (L., 1758)
Nemidia torelli Malmgren, 1865

Protodrilidae

Protodriloides chaetifer (Remane, 1926)
Protodrilus sp. A

Psammodrilodae

Psammodrilus balanoglossoides Swedmark, 1952

Questidae

Novaquesta trifurcata Hobson, 1970

Sabellidae

Amphiglena sp. A
Chone duneri Malmgren, 1867
Chone infundibuliformis Kröyer, 1856
Chone sp. A
Chone sp. B
Euchone nr. *elegans* Verrill, 1873
Euchone hancocki Banse, 1970
Euchone incolor Hartman, 1965
Euchone sp. A
Jasmineira cf. *filiformis* Hartman, 1965
Megalomma bioculata (Ehlers, 1887)
Myxicola infundibulum (Renier, 1804)
Oriopsis sp. A
Potamilla neglecta (Sars, 1851)
Potamilla reniformis (Leukart, 1849)

Scalibregmatidae

Scalibregma inflatum Rathke, 1843

Serpulidae

Filograna implexa (Berkeley, 1851) (*Salmacina* - form)
Protula tubularia (Montagu, 1803)

Sigalionidae

Pholoe minuta (Fabricius, 1780)
Sigalion arenicola Verrill, 1879
Sigalion sp. A
Sthenelais picta Verrill, 1881
Sthenelais limicola (Ehlers, 1864)

Sphaerodoridae

Clavodorum sp. A
Sphaerephesia nr. *similisetis* Fauchald, 1972
Sphaerodoridae sp. A
Sphaerodoridium sp. A
Sphaerodoropsis corrugata Hartman & Fauchald, 1971
Sphaerodoridium claparedii (Greeff, 1866)
Sphaerodorum gracilis (Rathke, 1843)
Sphaerodorum sp. A

Spionidae

Aonides paucibranchiata Southern, 1914
Apoprionospio dayi Foster, 1969
Laonice cirrata (Sars, 1851)
Malacoceros indicus Fauvel, 1928
Microspio pigmentata (Reish, 1959)
Polydora aggregata Blake
Polydora barbilla Blake, 1981
Polydora nr. *caeca* Oersted, 1843
Polydora caulleryi Mesnil, 1897
Polydora concharum Verrill, 1880
Polydora ligni Webster, 1879
Polydora socialis (Schmarda, 1861)
Polydora n. sp. A
Polydora n. sp. B
Polydora n. sp. C
Prionospio cirrifera Wirén, 1883
Prionospio aff. *cirrobranchiata* Day, 1961
Prionospio dubia Day, 1961
Prionospio steenstrupi Malmgren, 1867
Prionospio n. sp. A
Prionospio n. sp. B
Scolelepis squamata (Müller, 1789)
Scolelepis texana Foster, 1971

Spio cf. armata (Thulin, 1957)
Spio filicornis (Müller, 1776)
Spio limicola Verrill, 1879
Spiophanes bombyx (Claparède, 1870)
Spiophanes kroeyeri Grube, 1860
Spiophanes wigleyi Pettibone, 1962
Spiophanes sp. A
Spionidae n. gen., n. sp. A
Spionidae n. gen., n. sp. B

Spintheridae

Spinther citrinus (Stimpson, 1854)

Spirorbidae

Spirorbidae sp. A

Sternaspidae

Sternaspis scutata (Renier, 1807)

Syllidae

Ambloysyllis sp. A
Amblyosyllis sp. B
Autolytus prolifer (O. F. Müller, 1788)
Eusyllis blomstrandi Malmgren, 1867
Eusyllis lamelligera Marion & Bobretzky, 1875
Exogone hebes (Webster & Benedict, 1884)
Exogone naidena Oersted, 1845
Exogone verugera (Claparède, 1868)
Langerhansia cornuta Rathke, 1843
Odontosyllis longiseta Day, 1973
Parapionosyllis longicirrata (Webster & Benedict, 1884)
Procerea cornuta (Agassiz, 1863)
Procerea fasciata (Bosc, 1802)
Sphaerosyllis cf. brevifrons Webster & Benedict, 1884
Sphaerosyllis sp. B
Streptosyllis arenae Webster & Benedict, 1884
Streptosyllis varians Webster & Benedict, 1887
Streptosyllis websteri Southern, 1914
Streptosyllis sp. A
Syllides benedicti Banse, 1971
Syllides japonica Imajima, 1966

Syllides sp. A
Syllides sp. B
Syllides sp. C
Syllides sp. D
Syllides sp. E
Syllides sp. F (nr. *convoluta* Webster & Benedict, 1884)
Typosyliis alternata (Moore, 1908)
Typosyllis hyalina (Grube, 1863)
Typosyllis tegulum Hartman & Fauchald, 1971

Terebellidae

Amaena triloba (Sars, 1863)
Amphitrite affinis Malmgren, 1866
Eupolymnia nebulosa (Montagu, 1818)
Leaena nr. *abranchiata* (Sars, 1865)
Leaena minima Hartman & Fauchald, 1971
Nicolea venustula (Montagu, 1818)
Nicolea zostericola (Oersted, 1844)
Pista palmata Verrill, 1873
Polycirrus eximius (Leidy, 1855)
Polycirrus medusa Grube, 1850
Polycirrus phosphoreus Verrill, 1880
Polycirrus sp. A
Polycirrus sp. B
Polycirrus sp. F
Polycirrus sp. G
Polycirrus sp. I
Proclea sp. A
Streblosoma sp. A
Terebella nr. *lapidaria* L., 1767
Thelepus n. sp. A

Trichobranchidae

Terebellides stroemi Sars, 1835
Trichobranchus glacialis Malmgren, 1866
Trichobranchus roseus (Malmgren, 1874)

Trochochaetidae

Trochochaeta nr. *carica* (Birula, 1897)

Family Undetermined

Aberranta enigmatica Hartman, 1965
Polychaeta sp. A
Polychaeta sp. B

ARCHIANNELIDA

Archiannelida sp. A

PHORONIDA

Phoronida sp. A

PRIAPULIDA

Priapulid sp. A

SIPUNCULA

Golfingia eremita (Sars, 1851)
Golfingia margaritacea (Sars, 1851)
Golfingia minuta (Keferstein, 1865)
Phascolion strombi (Montagu, 1804)
Phascolopsis gouldi (Pourtales, 1851)

MOLLUSCA

GASTROPODA

Prosobranchia

Alvania cf. acuticostata (Dall, 1889)
Alvania castanea Möller, 1842
Alvania exarata Stimpson, 1851
Alvania harpa Verrill, 1882
Alvania mighelsii (Stimpson, 1851)
Alvania pelagica (Stimpson, 1851)
Amphissa haliaeeti (Jeffreys, 1897)
Buccinum undatum L., 1758
Cocculina beanii Dall, 1882
Colus parvus (Verrill & Smith, 1882)
Colus pygmaeus (Gould, 1841)
Colus sabinii (Gray, 1824)
Colus stimpsoni (Mörch, 1867)
Colus spp.
Crepidula fornicata (L., 1758)
Crepidula plana Say, 1822
Crucibulum striatum Say, 1824
Epitonium championi Clench & Turner, 1952
Epitonium dallianum (Verrill & Smith, 1880)
Epitonium multistriatum (Say, 1826)
Lunatia heros (Say, 1822)
Mitrella dissimilis (Stimpson, 1851)
Moelleria costulata (Möller, 1842)
Nassarius trivitatus (Say, 1822)
Neptunea decemcostata Say, 1826

Polynices immaculatus (Totten, 1834)
Polynices nanus (Möller, 1842)
Scissurella crispata (Fleming, 1828)
Solariella obscura (Couthouy, 1838)
Turritellopsis cf. acicula (Stimpson, 1851)
Velutina velutina (Müller, 1776)
Gastropod sp. B, sp. C

Opisthobranchia

Adalaria proxima (Alder & Hancock, 1854)
Cadlina laevis (L., 1767)
Coryphella verrilli
Cylichna alba (Brown, 1827)
Cylichna gouldi (Couthouy, 1839)
Dendronotus frondosus (Ascanius, 1774)
Diaphana minuta (Brown, 1827)
Doridella obscura Verrill, 1870
Doto coronata (Gmelin, 1792)
Eubranchus sp. A
Limacina leseueurii (Orbigny, 1836)
Limacina retroversa (Fleming, 1823)
Limacina trochiformis (Orbigny, 1836)
Odostomia dealbata (Stimpson, 1851)
Odostomia eburnea (Stimpson, 1851)
Odostomia gibbosa Bush, 1909
Odostomia impressa (Say, 1821)
Odostomia modesta Stimpson, 1851
Odostomia sulcosa (Mighels, 1843)
Odostomia spp.
Okenia sp. A
Onchidoris aspera Alder & Hancock, 1842
Onchidoris cf. tenella Gould, 1870
Philine lima (Brown, 1827)
Philine tincta Verrill, 1882
Pleurobranchia tarda Verrill, 1880
Retusa obtusa (Montagu, 1807)
Aeolidiidae sp. A
Naticidae sp. A
Nudibranch sp. B, sp. C

BIVALVIA

Anomia squamula L., 1758
Anomia spp.
Arctica islandica (L., 1767)
Astarte borealis (Shumacher, 1817)
Astarte castanea (Say, 1822)
Astarte montagui (Dillwyn, 1817)

Astarte quadrans Gould, 1841
Astarte crenata subequilatera Sowerby, 1854
Astarte undata Gould, 1841
Astarte sp. A
Bathyarca pectunculoides Scacchi, 1833
Cardiomya perrostrata (Dall, 1881)
Cerastoderma pinnulatum (Conrad, 1831)
Corbula contracta Say, 1822
Crenella decussata (Montagu, 1808)
Crenella fragilis Verrill, 1885
Crenella glandula (Totten, 1843)
Crenella sp. juvenile
Cuspidaria cf. parva Verrill and Bush, 1898
Cuspidaria pellucida Stimpson, 1853
Cuspidaria rostrata (Spengler, 1783)
Cyclocardia borealis (Conrad, 1831)
Dacrydium vitreum (Holboll, 1842)
Diplodonta sp. A
Ensis directus Conrad, 1843
Hiatella arctica (L., 1767)
Leptonacea sp. B
Limatula subauriculata (Montagu, 1808)
Limopsis sulcata Verrill & Bush, 1898
Lucinoma filosa (Stimpson, 1851)
Lyonsia granulifera Verrill & Bush, 1898
Lyonsia hyalina Conrad, 1831
Modiolus modiolus (L., 1758)
Musculus niger (Gray, 1824)
Mysella planulata (Stimpson, 1857)
Mytilus edulis Linne 1787
Nucula delphinodonta Mighels & Adams, 1842
Nucula proxima Say, 1822
Nucula sp. juvenile
Nuculana messanensis (Seguenza, 1877)
Nuculana pernula Muller, 1779
Nuculana tennisulcata Couthouy, 1858
Palliolum subimbrifer (Verrill & Bush, 1897)
Palliolum sp. B
Pandora gouldiana Dall, 1886
Periploma leanum (Conrad, 1831)
Periploma papyratium (Say, 1822)
Pitar morrhuanus Linsley, 1848
Placopecten magellanicus (Gmelin, 1791)
Poromya granulatum (Nyst & Westendorp, 1839)
Siliqua costata Say 1822
Solemya borealis Totten, 1834
Solemya velum Say, 1822
Spisula solidissima (Dillwyn, 1817)

Tellina agilis Stimpson, 1857
Tellina tenella Verrill, 1874
Thracia septentrionalis Jeffreys, 1872
Thyasira sp. A, sp. B, sp. C, sp. D, sp. E
Thyasira spp.
Yoldia sapotilla (Gould, 1841)
Lasaeida sp. A
Bivalve sp. D, sp. F, sp. H,
Sp. J, sp. K, sp. L

SCAPHOPODA

Cadulus agassizii Dall, 1881
Cadulus sp. A
Dentalium entale stimpsoni Henderson, 1920
Siphonodentalium occidentale Henderson, 1920
Siphonodentalium bushi Henderson, 1920
cf. Siphonodentalium tythum Watson, 1879

POLYPLACOPHORA

Hanleya sp. A
Leptochiton sp. A
Leptochiton sp. B
Polyplacophora sp. A

APLACOPHORA

Chaetoderma nitidulum Lovèn, 1884
Chaetoderma sp. A
Nierstrassia fragile Heath, 1918
Neomeniomorpha sp. A, sp. B, sp. C, sp. D, sp. E,
sp. F

ARTHROPODA

ARACHNIDA

Acarina

PYCNOGONIDA

Anoplodactylus lentus Wilson, 1878
Anoplodactylus sp. A
Nymphon grossipes Kröyer, 1780

CRUSTACEA

CEPHALOCARIDA

Hutchinsoniella macracantha Sanders, 1955

OSTRACODA

Myodocopa

CIRRIPEDIA

Balanus sp. A

MALACOSTRACA

Stomatopoda

Lysiosquillidae

Platysquilla enodis (Mannings, 1962)

Cumacea

Bodotriidae

Mancocuma stellifera Zimmer, 1943
Pseudoleptocuma minor (Calman, 1912)

Diastylidae

Diastylis abbreviata Sars, 1871
Diastylis cornuifer (Blake, 1929)
Diastylis lucifera (Kröyer, 1841)
Diastylis polita (S.I. Smith, 1879)
Diastylis quadrispinosa (Sars, 1871)
Diastylis sculpta Sars, 1871
Diastylis sp. A
Diastylis sp. B
Diastylis sp. C
Diastylis spp.
Leptostylis longimana (Sars, 1865)
Leptostylis sp. A

Lampropidae

Lamprops quadriplicata S.I. Smith, 1879
Lamprops sp. A

Leuconidae

Eudorella pusilla Sars, 1871
Eudorellopsis deformis (Kröyer, 1846)

Nannastacidae

Campylaspis affinis Sars, 1870
Campylaspis rubicunda (Lilljeborg, 1855)
Campylaspis sp. A

Pseudocumatidae

Petalosarsia declivis (Sars, 1865)

Tanaidacea

Paratanaidae

Pseudoleptochelia filum (Stimpson, 1853)
Tanaissus lilljeborgi (Stebbing, 1871)
Typhlotanais nr. cornutus G.O. Sars, 1885

Isopoda

Anthuridae

Ptilanthura tricarina Menzies & Frankenberg, 1966
Ptilanthura sp. A

Aselloidea

Aselloidea sp. A

Bopyridae

Hemiarthrus abdominalis (Kröyer)

Cirolanidae

Cirolana borealis Lilljeborg, 1851
Cirolana polita (Stimpson, 1853)

Cryptoniscidae

Cryptoniscidae sp. A

Desmosomatidae

Desmosomatidae sp. A

Eurycopidae

Eurycope mutica Sars, 1863

Idoteidae

Chiridotea arenicola Wigley, 1960
Chiridotea tuftsi (Stimpson, 1853)
Edotea acuta Richardson, 1900
Edotea triloba (Say, 1818)
Edotea sp. B

Janiridae

Janira alta (Stimpson, 1853)
Janira sp. A

Munnidae

Munna fabricii Kröyer, 1846-1849
Munna sp. A
Munna sp. B
Pleurogonium inerme Sars
Pleurogonium spinosissmum (Sars, 1865)
Munnidae sp. A

Amphipoda - Hyperiidea

Hyperiidae

Hyperia galba (Montagu)
Parathemisto gaudichaudii (Guerin, 1825)

Amphipoda - Gammaridea

Argissidae

Argissa hamatipes (Norman, 1869)

Ampeliscidae

Ampelisca agassizi (Judd, 1896)
Ampelisca macrocephala Lilljeborg, 1852

Ampelisca vadorum Mills, 1963
Byblis serrata (Smith, 1873)
Byblis sp. A
Haploops sp. A

Amphilochidae

Gitana nr. sarsi Boeck, 1871
Gitanopsis nr. inermis (Sars, 1882)
Paramphilochoides odontonyx (Boeck, 1871)
Paramphilochoides sp. A

Aoridae

Leptocheirus pinguis (Stimpson, 1853)
Microdeutopus anomalus (Rathke, 1843)
Pseudunciola obliquua (Shoemaker, 1949)
Unciola inermis Shoemaker, 1945
Unciola irrorata Say, 1818
Unciola spicata Shoemaker, 1945
Unciola spp. juveniles
Aoridae sp. A

Calliopiidae

Calliopius laeviusculus (Kröyer, 1838)
Haliragoides inermis (Sars, 1882)

Corophiidae

Corophium acutum Chevreux, 1908
Corophium crassicorne Bruzelius, 1859
Erichthonius rubricornis (Stimpson, 1853)
Siphonoecetes colletti (Myers & McGrath, 1979)

Eusiridae

Rhachotropis inflata (G.O. Sars, 1882)

Haustoriidae

Acanthohaustorius intermedius Bousfield, 1965
Acanthohaustorius millsi Bousfield, 1965
Acanthohaustorius shoemakeri Bousfield, 1965
Acanthohaustorius similis Frame, 1980
Acanthohaustorius spinosus Bousfield, 1962
Bathyporeia quoddyensis Shoemaker, 1949

Parahaustorius attenuatus Bousfield, 1965
Parahaustorius longimerus Bousfield, 1965
Protohaustorius wigleyi Bousfield, 1965
Pseudohaustorius carolinensis Bousfield, 1965

Ischyroceridae

Ischyrocerus sp. A
Ischyrocerus sp. B

Liljeborgidae

Liljeborgidae sp. A
Idunella bowenae Karaman, 1983

Lysianassidae

Anonyx liljeborgi Kröyer, 1870
Anonyx sp. A
Hippomedon serratus Holmes, 1903
Lysianassidae sp. A
Lysianassidae sp. B
Lysianassidae sp. C
Orchomene sp. A

Melitidae

Casco bigelowi (Blake, 1929)
Eriopisa elongata (Bruzelius, 1859)
Jerbarnia americana Watling, 1981
Melita dentata Kröyer, 1842
Melita sp. A
Melitidae sp. B

Melphidippidae

Melphidippa cf. borealis Boeck, 1870

Oedicerotidae

Monoculodes edwardsi Holmes, 1905
Monoculodes sp. A
Monoculodes sp. C
Monocolodes sp. D
Monoculodes sp. E (= Monoculodes sp. A, Watling, 1979)
Oedicerotidae sp. A

Platyischnopidae

Skaptopus _brychius_ Thomas & Barnard, 1983

Paramphithoidae

Epimeria _obtusa_ Watling, 1981

Photidae

Gammaropsis _nitida_ (Stimpson, 1853)
Gammaropsis _sophiae_ (Boeck, 1861)
Photis _dentata_ Shoemaker, 1945
Photis _pollex_ (Walker, 1895)
Photis _reinhardi_ Kröyer, 1842
Photidae sp. A

Phoxocephalidae

Harpinia _propinqua_ G.O. Sars, 1891
Harpinia _truncata_ G.O. Sars, 1891
Phoxocephalus _holbolli_ Kröyer, 1842
Rhepoxynius _hudsoni_ Barnard and Barnard, 1982
Phoxocephalidae sp. A

Pleustidae

Pleusymtes _glaber_ Boeck, 1861
Stenopleustes _gracilis_ Holmes, 1905
Stenopleustes _inermis_ Shoemaker, 1949
Pleustidae sp. A
Pleustidae sp. B

Podoceridae

Dyopedos _monacanthus_ (Metzger, 1875)

Pontogeneiidae

Pontogeneia _inermis_ (Kröyer, 1842)

Stenothoidae

Metopa nr. _borealis_
Metopa sp. A
Metopella _angusta_ Shoemaker, 1949
Metopella sp. A
Parametopella _cypris_ (Holmes, 1905)
Proboloides _holmesi_ Bousfield, 1973

Stegocephalidae

Andaniopsis nordlandica (Boeck, 1871)

Amphipoda sp. A,B,C,G, I, J

Amphipoda - Caprellidea

Caprellidae

Aeginella spinosa Boeck, 1861
Aeginina longicornis (Kröyer, 1842-43)
Caprella linearis (Linnaeus, 1767)
Caprella unica Mayer, 1903

Mysidacea

Mysidae

Erythrops erythrophthalma (Goes, 1863)
Heteromysis formosa Smith, 1873
Mysidopsis bigelowi Tattersall, 1926
Mysidae sp. A
Pseudomma sp. A

Euphausiacea

Meganyctiphanes norvegica (Sars, 1857)
Euphausiacea sp.

Decapoda

Caridea

Natantia

Crangonidae

Crangon septemspinosa Say, 1818
Pontophilus brevirostris Smith, 1881

Hippolytidae

Hippolytidae sp. A

Palaemonidae

Palaemonetes sp. A

Pandalidae

Dichelopandalus leptoceras (Smith, 1881)
Pandalus borealis Kröyer, 1838
Pandalus montagui Leach, 1813

Sergestidae

Lucifer faxoni Borradaile, 1915

Reptantia

Anomura

Axiidae

Axiidae sp. A
Axiidae sp. B

Galatheidae

Munida iris Edwards, 1880
Galatheidae sp. A

Paguridae

Pagurus acadianus Benedict, 1901
Pagurus annulipes Stimpson, 1860
Pagurus arcuatus Squires, 1964
Pagurus politus (Smith, 1882)
Pagurus pubescens Kröyer, 1838
Pagurus sp. A
Pagurus sp. B

Brachyura

Canceridae

Cancer borealis Stimpson, 1859
Cancer irroratus Say, 1817

Majidae

Euprognatha rastellifera Rathbun, 1925
Hyas coarctatus Leach, 1815

Ocypodidae

Ocypode quadrata (Fabricius, 1787)

Portunidae

Brachyura sp. A

ECTOPROCTA

Tubuliporidae

Idmonea atlantica (Johnson, 1847)

Diastoporidae

Diplosolen obelia (Johnston, 1838)

Crisiidae

Crisia eburnea (L., 1758)

Lichenoporidae

Lichenopora hispida (Fleming, 1828)

Walkeriidae

Walkeria sp. A

Nolellidae

Nolella sp. A

Alcyonidae

Alcyonidium parasiticum (Fleming, 1826)
Alcyonidium polyoum (Hassall, 1841)

Flustrellidridae

Flustrellidra hispida (Fabricius, 1780)

Scruparidae

Haplota clavata (Hincks, 1857)

Eucrateidae

Eucratea loricata (L., 1758)

Calloporidae

Amphiblestrum osburni Powell, 1968
Amphiblestrum trifolium (Wood, 1844)
Callopora aurita (Hincks, 1877)
Callopora craticula (Alder, 1957)
Callopora dumerilii (Audouin, 1826)
Callopora lineata (L., 1767)

Membraniporidae

Membranipora tenuis Desor, 1848
Membranipora tuberculata (Bosc, 1802)

Electridae

Electra arctica Borg, 1931
Electra pilosa (L., 1767)

Bicellariellidae

Bicellariella ciliata (L., 1758)

Bugulidae

Bugula stolonifera Ryland, 1960
Dendrobeania murrayana (Johnston, 1847)

Calpensiidae

Microporina sp. A

Cribilinidae

Cribilina punctata (Hassall, 1841)

Cryptosulidae

Cryptosula pallasiana (Moll, 1803)

Escharellidae

Escharella ventricosa (Hassall, 1842)

Hipporinidae

Hipporina pertusa (Esper, 1791)

Schizoporellidae

Schizoporella biaperta (Michelin, 1841)
Schizoporella unicornis (Johnston, 1847)

Smittinidae

Parasmittina nitida (Verrill, 1875)
Porella reduplicata (Osburn, 1933)

Hippothoidae

Hippothoa divaricata Lamouroux, 1821

ECHINODERMATA

ECHINOIDEA

Brisaster fragilis (Duben & Koren)
Echinarachnius parma (Lamarck, 1816)
Echinocardium flavescens (O. Müller)
Echinoidea sp. A (probably juv. E. parma)
Echinoidea sp. B juvenile
Echinoidea sp. C juvenile
Spatangoidea spp. juvenile

OPHIUROIDEA

Amphioplus abditus (Verrill, 1871)
Amphipholis squamata (Delle Chiaje, 1828)
Amphitarsus spinifer Schoener, 1967
Ophiopholis aculeata (L.)
Ophiura robusta (Ayres, 1851)
Ophiuroidea sp. A juvenile
Ophiuroidea sp. B juvenile
Ophiuroidea sp. C
Ophiuroidea sp. D
Ophiuroidea sp. E
Ophiuroidea sp. G juvenile
Ophiuroidea sp. H juvenile

CRINOIDEA

Hathrometra sp. A

ASTEROIDEA

Astropecten americanus Verrill, 1880
Leptasterias tenera (Stimpson, 1862)
Asterias forbesi (Desor, 1848)
Asterias vulgaris Verrill, 1866
Forcipulata sp. A
Forcipulata sp. B juvenile
Forcipulata sp. C
Paxillosida sp. A juvenile
Asteroidea sp. B juvenile
Asteroidea sp. C juvenile
Asteroidea sp. D juvenile

HOLOTHUROIDEA

Cucamaria frondosa (Gunnerus, 1770)
Duasmodactyla commune (Forbes, 1841)
Haevlockia scabra (Verrill, 1873)
Holothuroidea sp. A
Holothuroidea spp. juvenile
Leptosynapta tenuis (Ayres, 1851)

HEMICHORDATA

Enteropneusta sp. A
Enteropneusta sp. B
Enteropneusta sp. D
Enteropreusta sp. E

CHORDATA

UROCHORDATA

Ascidiacea sp. A
Ascidiacea sp. B
Ascidiacea sp. C
Ascidiacea sp. D
Ascidiacea sp. E

VERTEBRATA

Ammodytes americanus De Kay, 1842
Neoliparis atlanticus (Jordan & Evermann, 1898)
Omochelys cruentifer (Goode & Bean, 1896)
Scomber scombrus L. 1758
Urophycis chuss Walbaum, 1792

APPENDIX B

TABLE B-1. SPECIES RETAINED AS VOUCHER SPECIMENS FROM DREDGE OR TRAWL SAMPLES FROM REGIONAL STATION 2.

	M-2	M-3	M-4	M-5	M-6	M-7	M-8
PORIFERA							
Haliclona oculata (Pallas, 1766)		X					
Polymastia robusta Verrill, 1873	X	X					
CNIDARIA							
Hydrozoa							
Campanularia gigantea Hincks, 1865		X					
Sertularella minuscula Billard, 1924	X						
Sertularella tricuspidata (Alder, 1856)		X					
Thuiaria cupressina (L., 1758)	X	X					
Tubularia couthouyi Agassizi, 1862		X					
MOLLUSCA							
Gastropoda							
Buccinum undatum L., 1758		X					
Colus pubescens (Verrill, 1882)		X		X			
Colus stimpsoni (Mörch, 1867)	X						
Bivalvia							
Arctica islandica (L., 1767)	X	X					
Cyclocardia borealis (Conrad, 1831)	X	X					
Palliolum sp. A	X						
Placopecten magellanicus (Gmelin, 1791)		X					
ARTHROPODA							
Amphipoda							
Aeginina longicornis (Kröyer, 1842-43)		X					
Caprella unica Mayer, 1903		X					
Erichthonius rubricornis (Stimpson, 1853)		X					
Decapoda							
Crangon septemspinosa Say, 1818		X					
Pagurus acadianus Benedict, 1901		X					
Pelia sp.		X					
ECTOPROCTA							
Flustrellidra hispida (Fabricius, 1780)	X						
Electra pilosa (L., 1767)	X						
Canloramphus cymbaeformis (Hincks, 1877)	X						
ECHINODERMATA							
Echinoidea							
Echinarachnius parma (Lamarck, 1816)	X	X					
Asteroidea							
Asterias vulgaris Verrill, 1866	X	X					
Leptasterias tenera (Stimpson, 1862)		X					
Forcipulata sp. C	X						
Henricia sp.				X			
Holothuroidea							
Stereoderma unisemita (Stimpson, 1851)		X					
CHORDATA							
Vertebrata							
Raja erinacea Mitchell, 1925		X					
Urophycis chuss (Walbaum, 1792)		X					

TABLE B-2. SPECIES RETAINED AS VOUCHER SPECIMENS FROM DREDGE OR TRAWL SAMPLES FROM REGIONAL STATION 7.

	M-2	M-3	M-4	M-5	M-6	M-7	M-8
MOLLUSCA							
Bivalvia							
Arctica islandica (L., 1767)	X						
ARTHROPODA							
Crustacea							
Decapoda							
Munidia iris Milne Edwards, 1880	X	X					
Pagurus politus (Smith, 1882	X						
Bathynectes superbus (Costa, 1838)		X					
ECHINODERMATA							
Asteroidea							
Asterias vulgaris Verrill, 1866	X						

TABLE B-3. SPECIES RETAINED AS VOUCHER SPECIMENS FROM DREDGE OR TRAWL SAMPLES FROM REGIONAL STATION 13.

	M-2	M-3	M-4	M-5	M-6	M-7	M-8
PLATYHELMINTHES							
Nemertea							
Cerebratulus sp.	X						
ANNELIDA							
Polychaeta							
Aricidea catherinae Laubier, 1967	X						
Chone infundibuliformis Kröyer, 1856	X						
Cossura longocirrata Webster & Benedict, 1887	X						
Harmothoe extenuata (Grube, 1840)	X						
Lumbrineris fragilis (Müller, 1776)	X						
Nephtys incisa Malmgren, 1865	X						
Ninoe nigripes Verrill, 1873	X						
MOLLUSCA							
Gastropoda							
Colus stimpsoni (Mörch, 1867)	X						
Illex illecebrosus (LeSueur, 1821)				X			
ARTHROPODA							
Crustacea							
Amphipoda							
Ampelisca agassizi (Judd, 1896)	X						
Anonyx liljeborgi Kröyer, 1870	X						
Unciola irroratus Say, 1818	X						
Decapoda							
Cancer borealis Stimpson, 1859	X						
ECHINODERMATA							
Asteroidea							
Asterias vulgaris Verrill, 1866	X						
Leptasterias tenera (Stimpson, 1862)	X						
CHORDATA							
Vertebrata							
Poronotus triacanthus (Peck, 1800)					X		

TABLE B-4. SPECIES RETAINED AS VOUCHER SPECIMENS FROM DREDGE OR TRAWL SAMPLES FROM GEORGES BANK SITE-SPECIFIC STATION 5-1.

	M-2	M-3	M-4	M-5	M-6	M-7	M-8
MOLLUSCA							
Bivalvia							
Cyclocardia borealis (Conrad, 1831)	X						
ECTOPROCTA							
Eucratea loricata (L., 1758)	X						
ECHINODERMATA							
Asteroidea							
Asterias vulgaris Verrill, 1866	X						
Leptasterias tenera (Stimpson, 1862)	X						

TABLE B-5. SPECIES RETAINED AS VOUCHER SPECIMENS FROM DREDGE OR TRAWL SAMPLES FROM SITE-SPECIFIC STATION 5-18

	M-2	M-3	M-4	M-5	M-6	M-7	M-8
CNIDARIA							
Hydrozoa							
Thuiaria cupressina (L., 1758)		X					
Tubularia couthouyi Agassizi, 1862		X					
MOLLUSCA							
Bivalvia							
Arctica islandica (L., 1767)	X	X					
Cyclocardia borealis (Conrad, 1831)	X	X					
ARTHROPODA							
Decapoda							
Cancer borealis Stimpson, 1859		X					
Cancer irroratus Say, 1817	X						
ECTOPROCTA							
Eucratea loricata (L., 1758)		X					
Electra pilosa (L., 1767)		X					
ECHINODERMATA							
Echinoidea							
Echinarachnius parma (Lamarck, 1816)	X	X					
Asteroidea							
Asterias vulgaris Verrill, 1866	X	X					
Leptasterias tenera (Stimpson, 1862)	X	X					
Holothuroidea							
Cucumaria frondosa (Gunnerus, 1770)	X						
CHORDATA							
Vertebrata							
Squalus acanthus Linnaeus, 1758*				X			
Urophycis chuss (Walbaum, 1792)	X						

*Collected at Site-Specific Station 5-15.

TABLE B-6. SPECIES RETAINED AS VOUCHER SPECIMENS FROM DREDGE OR TRAWL SAMPLES FROM SITE-SPECIFIC STATION 5-28

	M-2	M-3	M-4	M-5	M-6	M-7	M-8
CNIDARIA							
Hydrozoa							
Hydrallmania falcata (L., 1758)		X					
Thuiaria cupressina (L., 1758)		X					
ANNELIDA							
Polychaeta							
Glycera dibranchiata Ehlers, 1868		X					
Lumbrineris fragilis (Müller, 1776)		X					
Ophelina acuminata Oersted, 1843		X					
MOLLUSCA							
Bivalvia							
Cyclocardia borealis (Conrad, 1831)	X	X					
ARTHROPODA							
Decapoda							
Cancer borealis Stimpson, 1859		X					
Cancer irroratus Say, 1817	X						
Pagurus acadianus Benedict, 1901		X					
ECHINODERMATA							
Echinoidea							
Echinarachnius parma (Lamarck, 1816)	X						
Asteroidea							
Asterias vulgaris Verrill, 1866	X	X					
Leptasterias tenera (Stimpson, 1862)	X	X					
Holothuroidea							
Cucumaria frondosa (Gunnerus, 1770)	X						
CHORDATA							
Vertebrata							
Paralichthys oblongus (Mitchill, 1815)			X				
Glyptocephalus cynoglossus (L., 1758)*				X			

*Collected between Site-Specific Stations 5-14 and 5-22.

APPENDIX C

APPENDIX C

ANNOTATED SPECIES LIST

PORIFERA

Calcarea sp. A

Resembling Sycon in being solitary tubes yet lacking long spicule fringe around osculum. Resembles Leucosolenia but differs in having a rough or tufted surface texture.

Suberitidae sp. A

An encrusting form with large tylostyles, with the rounded end next to substratum but differing in having spirasters as microscleres. Small sponge always found encrusting sand grains. Most common sponge.

CNIDARIA: HYDROZOA

Eucopella sp. A

Characterized by a very large gonophore. Similar to Eucopella caliculata except hydrothecal margin toothed instead of entire.

Eudendrium sp. A

Specimens incomplete but agreeing with genus Eudendrium.

Halecium sp. B

Overall structure similar to Halecium articulosum but differing in that hydrophores alternate at 90° angles to one another, whereas hydrophores of H. articulosum alternate at a full 180° to one another.

Halecium sp. C

Shape resembling Lafoea spp. but hydrophores commonly reduplicated one or two times, a common characteristic of Halecium.

Lovenella sp. A

Resembling Lovenella grandis in shape and structure but much smaller.

Thuiaria cupressina (L., 1758)

Most common hydrozoan.

ANTHOZOA

Edwardsia sp. A,B,C

All specimens poorly preserved, with tentacles withdrawn or lost; all with multiples of eight mesentaries and tentacles.

Halcampidae sp. A

Family assignment due to very large longitudinal muscles of mesentaries and fine mucus covering, all specimens in very poor shape and could not be assigned a genus and species.

Hexactiniae sp. A,B,C,D,E,F,G,H

All forms with multiples of six mesentaries and tentacles.

NEMERTEA

Most nemerteans are very difficult if not impossible to identify unless sectioned.

Lineus sp. A

Specimens without caudal cirrus; with longitudinal cephalic grooves.

Micrura sp. A

Specimens with caudal cirrus present and without thin lateral margins.

Monostylifera sp. A

Specimens with stylet. Rare.

ANNELIDA: POLYCHAETA

AMPHARETIDAE

Asabellides sp. A

Four pairs branchiae; with long dorsal neuropodial cirrus; peristomium narrow; one pair long anal cirri and short papillae.

Eclysippe sp. A

Paleae present; with 3 pairs branchiae; 12 thoracic uncinigers; with ventral glandular band on setiger 5.

Lysippe sp. A

Short paleae on segment 3. With 4 pairs branchiae; anal cirri with 2 eyes; with enlarged notopodial lobes on setiger 10.

Samythella sp. A

Paleae absent; with 3 pairs branchiae; 12 thoracic uncinigers; without notopodial rudiments.

Ampharetidae, new genus, new species A

Paleae present; with 4 pairs branchiae; 12 thoracic uncinigers; with notopodial rudiments.

Ampharetidae, new genus, new species B

Paleae absent; with 3 pairs branchiae; 11 thoracic uncinigers; with notopodial rudiments.

Ampharetidae, new genus, new species C

Paleae reduced; with 4 pairs branchiae; 2 thoracic uncinigers; enlarged notopodia with long brushtipped setae on last thoracic setiger.

Ampharetidae, new genus, new species D.

Paleae absent; with 2 pairs branchiae and 1 pair nephridia; 13 thoracic uncinigers; several dark eyes.

APHRODITIDAE

Aphrodita hastata Moore, 1905

Juveniles with neurosetae having basal spur and few marginal teeth; thus intermediate between typical A. hastata and the European A. aculeata.

ARABELLIDAE

Arabella sp. A

Prostomium without eyes; simple limbate capillaries present, lacking denticulation at base of winged plate; upper edge of mandibles smooth; anterior parapodial lobes appear receded into body wall.

cf. Drilognathus sp. A

Yellow acicular spines not projecting; setae absent, or if present, reduced, shrunken in appearance; maxillary apparatus reduced to maxillary carriers with small, vestigal, fused mass above it; mandibles well developed; anterior parapodia bilabiate; one specimen found in Lumbrineris acuta host.

Drilonereis longa Webster, 1879

Anterior parapodia reduced to swelling; middle parapodia with short presetal lobe, long postsetal lobe; posterior parapodia with presetal lobe short to slightly subequal to the long postsetal lobe; limbate setae with long capillary tips. Number of teeth on maxillary apparatus: MI, 4-6; MII, 4-5; MIII, 1. May be confused with D. n. sp. A (see below).

Drilonereis n. sp. A

Anterior parapodia with presetal lobe absent, postsetal lobe short; middle parapodia with presetal lobe short, postsetal lobe long; posterior parapodia with presetal lobe slightly subequal to long postsetal lobe; limbate capillary setae with long limbations and short capillary tip. Number of teeth on maxillary aparatus: MI, 2-3, MII, 2-3, MIII, 2. (Compare with D. longa).

Drilonereis n. sp. B

Parasitic with Aricidea catherinae.

Drilonereis n. sp. C

Parasitic with paraonid.

Drilonereis n. sp. D

Parasitic with cirratulid.

ARCHIANNELIDA

Archiannelida sp. A

Probably Protodrilidae. Anterior end expanded, with two palps, eyes lacking. Ciliated area posterior to mouth tapering to long ciliated tract extending posteriorly. Segmentation indistinct, only one segmental boundary detected. Setae lacking. Cuticle thick, oligochaete-like. Found at Sta. 16 and 18.

CAPITELLIDAE

Barantolla sp. A

Setal formula: $\frac{6C}{0+5C} + \frac{h}{h}$; not a juvenile Capitella.

Capitella jonesi (Hartman, 1959)

Setal formula: $\frac{3C}{3C} + \frac{h}{h}$ ....; corresponds to Grassle and Grassle (1977) Type III.

Mediomastus fragilis Rasmussen, 1973

Without capillaries in abdominal notopodia; 2 eyes present. (See Warren, 1979).

CHRYSOPETALIDAE

Dysponetus gracillis Hartman, 1965

New to Continental Shelf. Previously known from slope depths. (See Hartman, 1965).

CIRRATULIDAE

Caulleriella n.sp. B

Prostomium very acute, with large dark eyes; bifid hooks numbering 2-3 per ramus; body smooth; gills tending to curl in preservation; pygidium with 2 anal cirri. Common at Sta. 5-1.

Caulleriella n.sp. C

Prostomium not acute, darkly pigmented, with 2 pair indistinct eyes; bifid hooks numbering 3-6 per ramus; hooks in far posterior setigers worn down to unidentate appearance; 2 anal cirri present. Found only at Sta. 14.

Chaetozone n.sp. A

Spines all acicular, not forming complete cinctures; pygidium a flattened disc.

Chaetozone n.sp. B

Similar to sp. A, but with both bifid hooks and blunt spines forming partial cinctures; with anal disc.

Dodecaceria n.sp. A

With modified setae having ribs, not spoon-shaped; resembles D. diceria Hartman (1951) from Gulf of Mexico.

Dodecaceria sp. B

Modified setae are spoon-shaped. Found at Station 5-25.

Tharyx acutus Webster & Benedict, 1887

Palps arising anterior to setiger 1; thoracic region not inflated; posterior end broad, with ventral depression; with short knob-tipped setae in posterior setigers directed toward ventral channel.

Tharyx annulosus Hartman, 1965

Palps arising on anterior edge of setiger 1; thoracic region slightly inflated, some segments pigmented ventrally; serrated capillary setae broad, with deep denticulations; posterior end weakly inflated.

Tharyx dorsobranchialis Kirkegaard, 1959

Prostomium very elongated, palps anterior to setiger 1; thoracic region strongly inflated, not pigmented; with lightly serrated capillaries; branchiae and parapodia dorsally elevated, forming medial channel in thorax. New to North America.

Tharyx nr. monilaris Hartman, 1960

Palps arising just anterior to setiger 1; body with an expanded thoracic region; with bead-like abdominal segments; all capillaries smooth, not serrated. A California species; new to eastern North America.

Tharyx n.sp. A

Palps arise over junction of peristomium and setiger 1; body circular in cross section throughout; setae few posteriorly, with simple blades, very thin, no serrations but may fray when bent; prostomium short; posterior end tapered. Common at site-specific stations.

Tharyx sp. D

Body greatly distended; palps arising just anterior to setiger 1; capillary notosetae narrow, smooth; some long natatory setae present; neurosetae shorter, thicker, curved, with serrations or fine saw-tooth edge. Found at Sta. 17.

Tharyx sp. E

Resembles Tharyx sp. A in general appearance, but is much larger; posterior segments with broad, finely serrated setae. Found at Sta. 14.

DORVILLEIDAE

Dorvillea sp. A

Specimens incomplete; parapodia as for Dorvillea or Schistomeringos, but furcate setae not evident.

Ophryotrocha sp. A

Small, rare, not fully characterized as yet. With heterogomph falcigers and simple setae. Mandibles with saw-toothed edge.

Ophryotrocha sp. B

Small, rare, not well-characterized as yet. Heterogomph falcigers present; mandibles with irregular edges. Antennae appear truncated, as if broken.

Schistomeringos sp. A, B, and D

These 3 taxa have been lumped with Schistomeringos caeca (Webster & Benedict, 1884).

Schistomeringos sp. C

Furcate setae with brush-tipped tines, 1/2 - 2/3 length ratio.

Dorvilleidae sp. A

Twelve setigers; one pair of palps; antennae lacking; two anal cirri. Without simple setae. Found at Stas. 5-16 and 5-20.

EUNICIDAE

Eunice vittata

Pigment spots on parapodia beginning on setiger 10-15, near area of gill attachment. Juveniles previously identified as Eunicidae sp. A. Northern range extension.

Marphysa stylobranchiata (Moore, 1909)

Previously Marphysa sp. A. Larger specimens with 5 short antennae; single gill filament starting from setiger 22-24, continuing along length of body, absent from posterior 25 setigers; tentacular cirri absent; subacicular dentition dark, unidentate and blunt; hooks of composite falcigers bifid, hoods rounded; pygidium bears a pair of long tapering ventral cirri and a pair of minute cirri below the longer pair. New to East Coast. Will be sent to Dr. Fauchald for confirmation.

Nematonereis unicornis (Grube, 1840)

Northern range extension.

FLABELLIGERIDAE

Flabelligera affinis Sars, 1829

Specimens are small and one from Sta. 18 is ovigerous. Cephalic cage formed by neuro- and notosetae of first segment; cage setae long and annulated; body transluscent, no mucoid sheath present; composite neurosetae from setiger 2, setae with long blades and shaft. Papillae long and pedunculate on some specimens.

Flabelligera sp. C

Cephalic cage on one setiger. Setae are capillaries and psuedocomposite setae with two joints. Differs from Flabelligera affinis, which has only one joint in each psuedocomposite seta. Papillae include both long and short forms; long papillae enlarged at tip, broadest in middle. Found at Sta. 12.

Pherusa nr. falcata (Støp-Bowitz, 1947)

Four segments with cephalic cage setae; neurosetae differ from P. falcata in form of the pseudocomposite setae.

Pherusa plumosa (Müller, 1776)

With stout simple hooks; cephalic cage with 3 setigers; setae have very slight structural inconsistency - a faint line. Tenuous identification.

Pherusa sp. A

With variable number of cephalic cage segments (1-4) depending on size; setae appearing pseudocomposite, dependent on size; may have 4 anterior segments with forwardly directed setae consisting of typical cephalic cage setae and composite hooks; possibly juvenile of Pherusa falcata or P. plumosa.

Flabelligeridae sp. A

Anterior three segments form a small cephalic cage, but setae are same length as rest of setae on body. All setae are simple annulated capillaries. Papillae pedunculate, include long and short forms. Body tapers posteriorly; some specimens have lost the tapering posterior end. One complete specimen with 32 segments. Probably in the genus Diplocirrus. Found at Sta. 14A.

GLYCERIDAE

Glycera n.sp. A

Similar to Glycera sp. A of Gardiner (1976); without branchiae.

GONIADIDAE

Goniada n.sp. A

Neuropodial presetal lobe bilobed from setiger 3; 61 uniramous parapodia, biramous from setiger 62 (no transitionals); subdermal eyes; 3-5 pair chevrons; short proboscidial organs; posterior notopodium with several slender capillaries; compound serrated spinigers in neuropodium; no anal cirri.

Goniadidae, new genus, new species A

Similar to Goniadella gracillis, but no chevrons on proboscis. Rare.

HESIONIDAE

Gyptis sp. A

Eight pairs easily lost tentacular cirri. Three antennae, center one closest to a frontal attachment, these also easily lost. Frontal attachment could possibly put this into a different genus although none exist into which these specimens would fit. Setae from second segment. More than 6 notosetae per bundle, therefore is not G. vittata. Notosetae are annulated capillaries; neurosetae include heterogomph falcigers. Dorsal cirri biarticulated along length of body; dorsal cirri shorter than parapodia and setae.

Microphthalmus listensis Westheide, 1967

New to New England or may actually be an undescribed species (Westheide, personal communication). Differs from M. sczelkowii in having dorsal and ventral cirri much longer than podial lobe, rather than subequal.

Microphthalmus sp. A

Notosetae include one aciculum per fascicle; neurosetae are compound. Dorsal and ventral cirri slightly shorter than tentacular cirri. Found at Sta. 10.

Hesionidae, new genus, new species A

With 8 pairs of tentacular cirri; 2 frontal antennae; parapodia biramous with articulated dorsal cirri; with fascicle of simple notosetae, neurosetae all composite falcigers. Close to Gyptis, but lacking medial antenna; may be Gyptis sp. A with antenna missing.

LUMBRINERIDAE

Lumbrinerides acuta (Verrill, 1875)

Position (setiger number) of first hooded hook directly correlated to length of animal, first appearing in setiger 1 of juveniles; in later segments in larger specimens.

Lumbrineris latreilli (Audouin & Milne Edwards, 1833) Variety

Blade length of composite setae variable (short and long); addition of composite setae to anterior parapodia increases as size of animal increases; Maxillae III unidentate (differs from bidentate condition in typical L. latreilli). Postsetal lobe digitiform, becoming more slender but not increasing in length in posterior segments, presetal lobe absent or reduced; prostomium conical; both anal cirri frequently bifid with unequal lengths. Juveniles appear to have simple setae and only 2 anal cirri. This form differs consistently from L. latreilli in that Maxillae III have 1 instead of 2 teeth.

Lumbrineris sp. B

Similar to Lumbrineris verrilli, but with shaft of hooded hook more swollen; posterior postsetal lobes of L. sp. B shorter than in L. verrilli; pygidium with 2 short and 2 long lobes.

Lumbrineris sp. C

Similar to Lumbrineris hebes. Prostomium small relative to size of body. Hooded hooks first look like limbate setae, but have extremely tiny teeth. Shortened in posterior setigers; hooks becoming larger and more like those of L. hebes. Maxillary carriers folded to various degrees. Max I = 1, Max II = 4-5?, Max III = 1, Max IV = 1 (broad plate).

Lumbrineris sp. D

Specimen 54 mm long, 3 mm wide. Mandible not fused. Max I = 1; Max II = 2,3; Max III = 2 (widely spaced); Max IV = 1. Prostomium conical with paired nuchal organs present near posterior margin. Postsetal lobe broadly conical becoming uniform in middle and posterior setigers; not increasing in length. Composite falcigers present from setigers 6 through 13, with blades 3-4 times longer than wide, with many small teeth and one larger fang inferiorly. Aciculum yellow. Pygidium with 4 cirri, dorsal pair longer.

MALDANIDAE

Axiothella sp. B

8 mm long; 19 setigers, and 5 achaetous preanal segments. Eyes present. Anal cirri alternate in length, usually with one long followed by three short cirri. Cephalic rim high, round with 2 shallow posteriolateral notches and 1 shallow posterior notch = 3 notches total. Rostrate uncini throughout, setiger 1 with 1 uncinus, setiger 2 with 2 uncini, setiger 3 with 3 uncini, increasing to 5 uncini in posterior setigers. Specimens stain differently than juveniles of Clymenella torquata, therefore this is not a C. torquata juvenile with undeveloped collar.

Axiothella sp. C

22 setigers and 4 achaetous preanal segments. Rostrate uncini throughout. Anal cirri all the same length.

Clymenura sp. A

19 setigers and 2(-3?) achaetous preanal segments. Eyespots on prostomium. Triangular patch on setiger 8. Nuchal slits appear parallel. Cephalic rim with 1 notch on posteriolateral side. First 3 setigers with acicular spines with small teeth. Anal cirri uniform in length, except one which is longer. Anal cone sometimes projects slightly beyond the cirri. Differs from Clymenura polaris which has only one anal cirrus. Differs from Clymenura borealis which has a posterior incision on the cephalic plate and anal cirri all of different lengths. First found at Sta. 12.

Euclymene sp. A

Eyes present; cephalic rim high, with posterior notch; 22 setigers and 2 achaetous preanal segments; many short anal cirri and one long midventral cirrus; neurosetae as for Euclymene, except in juveniles. This is the same species as that designated as E. collaris in Benchmark reports: a comparison of specimens collected in the two studies has been made.

Euclymene sp. B

Similar to Euclymene sp. A, except eyes lacking, no posterior notch in cephalic rim, floor of anal plaque level. Rare.

Euclymeninae sp. B

Cephalic plate well developed, rim low, shallowly incised laterally and posteriorly, nuchal organs short, distinct collar on setiger 4; anal funnel well developed, with larger mid-ventral cirrus and additional alternating long and short cirri; acicular spines on setigers 1-3.

Isocirrus planiceps (Sars, 1872)

Agrees with description by Arwidsson (1907) rather than with that by Imajima and Shiraki (1982).

Maldanella sp. A

19 setigers. Setiger 1 with notosetae only; neurosetae are all rostrate uncini. Cephalic rim with posteriolateral incision on each side. Anal cirri variable in length. Staining pattern: A) first 2 setigers and prostomium speckled, especially intense in presetal area on setigers 1 and 2, B) setiger 3 staining more darkly, especially presetally, C) setigers 4 - 7 very intensely speckled, D) staining in posterior region is primarily around the setal bundles. First found at Station 18.

Maldanidae sp. B

Eyes lacking; cephalic rim high with 3 incisions; spines in first 3 neuropodia; pygidium as for Heteroclymene robusta.

Maldanidae sp. C

Posterolateral margin of cephalic collar with about 8 incisions; first 3 setigers with rostrate setae.

Maldanidae sp. D

Similar to Praxillura, but does not agree with any known species in that genus. Pigment bands across dorsum of anterior segments more than reported; different number of spines in anterior segments; cephalic plate reduced; no anal plaque.

Maldanidae sp. E

Weak posterolateral incisions on cephalic plate; faint eye spots on ventrolateral cephalic plate; long ventral cirrus extending from anal funnel, with shorter cirri encircling margin.

Maldanidae sp. F

Incomplete specimens, but 9th setiger with distinctive, longitudinal stripes when stained. First 3-4 setigers with acicula in neuropodia. Cephalic rim with 3 indentations, 2 posterio-lateral and 1 posterior. First found at Sta. 12.

Maldanidae sp. G

Two complete specimens, one with 37 setigers and no achaetous preanal segments, the second with 32 setigers and 3 achaetous preanal segments. No indentations on cephalic rim. Setigers 1-3 with acicular setae. One anal cirrus. Setigers 1-3 stain in speckled pattern, which is especially prominent in presetal region; setigers 4 to 7-9 stain completely. Found at Stas. 13A, 14 and 14A.

NEPHTYIDAE

Aglaophamus circinata (Verrill, 1874)

Juveniles without eyes; second antennae long. Adult characters as in Pettibone (1963).

Nephtys bucera Ehlers, 1868

Juveniles with eyes; second antennae short. Adult characters as in Pettibone (1963).

Nephtys incisa Malmgren, 1865

Juveniles without eyes; antennae crowded on anterolateral corners of prostomium. Adult characters as in Pettibone (1963).

Nephtys picta Ehlers, 1868

Juveniles with eyes; second antennae long. Adult characters as in Pettibone (1963).

NEREIDAE

Nereis grayi Pettibone, 1956

Most common nereid at our Georges Bank Stations.

Nereis cf. *riisei* Grube, 1856

Similar to *N. riisei*, but posterior notopodial homogomph falcigers with smooth instead of serrated blade.

Nereis sp. A

Eyes appear as dotted pigment patterns. Paragnath formula: I = O, II = 1-2, III = 1, IV = row of 5, V = 0, VI = 1, VII & VIII = random pattern forming a band or irregular rows. Posterior notopodial falcigers smooth. Tentacular cirri extend back to setiger 4 or 5. Dorsal cirri equal in length to podial lobes in anterior and middle regions of body, but longer in posterior regions. Ventral cirri shorter than podial lobes in anterior and middle regions of body, equal in length in posterior region. Parapodial lobes conical. First found at Sta. 3 and 8.

Nereis sp. B

Four eyes, anterior 2 are semicircular. Paragnath formula: IV - several, none on other areas. Posterior notopodial falcigers serrated. Tentacular cirri extend back to setigers 4-5. Dorsal notopodial ligules reduced in posterior region. Dorsal cirri equal in length to podial lobes in anterior region and longer in posterior region. Ventral cirri equal in length to podial lobes throughout.

Nereis sp. G

Eyes large, round. Palps full, round. Paragnath formula: I = 0, II = 11, III = 3, IV = 9, V = 0, VI = 7, VII and VIII form a band with heavy paragnaths distally and lighter paragnaths proximally, spacing of paragnaths is regular with 2 light ones for each heavy one. Tentacular cirri extend back to setigers 3-5. Two long anal cirri. Posterior notopodial falcigers serrated. Dorsal cirri increase in length from anterior to posterior. Ligules somewhat pointed, dorsal-most notopodial ligule reduced, much shorter than dorsal cirri (at least in posterior region). Ventral cirri in posterior region are shorter than podial lobes. First found at Stas. 5-8.

ONUPHIDAE

Mooreonphis pallidula (Hartman, 1965)

Juveniles with 8-10 setigers, branchiae from setiger 6.

Mooreonuphis sp. A

Composite bi-and tridentate falcigers on setigers 1-4; spinigers start on setiger 5, continuing to 12 (rather than starting on setiger 6 and continuing to 17-28 as in M. pallidula); bifid subacicular setae start on setigers 6-11 (rather than setigers 18-19 as in M. pallidula). Ventral cirri cirriform until setiger 3, 4th transitional. Psuedocomposite falcigers present from setiger 1, present in 2-4 setigers; spinigers present from setigers 4-6, continue to setiger 8-18; bifid subacicular hooks present from setigers 5-6, continue to end of body. M. sp. A may be a juvenile of M. pallidula, with which it co-occurs.

Nothria conchylega (Sars, 1835)

Juveniles with branchiae developing late; first present after attaining 20 or more setigers.

Paronuphis sp. A

Juvenile, agrees with generic definition, need more specimens.

Rhamphobranchium sp. A

First three parapodia enlarged, equal in size and project forward; branchiae begin on setiger 11, with up to 6 filaments; ventral cirri cirriform on setiger 3, setiger 4 transitional; bidentate subacicular hooks begin on setigers 13-15. Pectinate setae and spinigers present, 3-4 large, slightly protruding acicular setae in anterior parapodia, occurring posterior to modified parapodia.

Rhamphobranchium sp. B

Differs from R. sp. A in following: first four parapodia enlarged, equal in size and appear capable of further expansion; branchiae begin on setiger 6, with 6-8

filaments; ventral cirri cirriform on setiger 5, setiger 6 transitional, bidentate subacicular hooks begin on setiger 19. The one specimen of R sp. B is very large relative to four R. sp. A specimens and may represent a later life history stage.

OPHELIIDAE

Ophelina sp. A

Similar to O. modesta Støp-Bowitz (1958). Anal funnel with terminal cirri and single ventral cirrus. Found at Sta. 18.

Travisia sp. A

Setae all smooth capillaries. Branchiae begin on setiger 2, continue to setiger 24. 6 anal lobes, up to 4 achaetous preanal segments. Differs from T. forbesii in having smooth rather than papillose skin, 6 rather than 8 anal papillae, and smooth rather than hispid capillary setae. Generic level characters for Travisia vary depending on the author. First found at Sta. 1.

Opheliidae sp. A

Setigers start in front of mouth, number 20, plus tail segment with up to 4 achaetous segments. No ventral groove. Setae all smooth capillaries. Branchiae start on setiger 3, continue to setiger 21. Found at Stas. 16, 17.

ORBINIIDAE

Leitoscoloplos sp. A

Prostomium appears more truncated than those of other species of Leitoscoloplos. Branchiae begin on setigers 8-12, somewhat rounded, not pointed. Ventral cirri (= subpodial papillae?) begin on setigers 8-11; only one ventral cirrus per side on each segment even in transitional region between thorax and abdomen. Ventral cirrus distinctive, round, constricted at point of attachment to body. Interramal cirri present. Abdominal neurosetae longer than notosetae.

OWENIIDAE

Myriochele nr. gosnoldi Hartman, 1965

3 incomplete specimens collected; 2 differ from Hartman's (1965) description in having an inflated prostomium anteriorly (although one appears to have the palps and the short prostomial frontal lobes retracted within anterior end); in having 14 and 23 setigers respectively, rather than 10 setigers as in the original description; all 3 specimens have long handled uncini which terminate distally in a long fang surmounted by a second tooth (secondary tooth not visible on all uncini in a torus). Hartman's "complete specimen" may have been regenerating a posterior end and the anterior end can be inflated perhaps due to contraction upon preservation. Hartman (1969) notes for M. californiensis that the uncini "are distally falcate, the tip oblique to the shaft and the accessory tooth small". The size variation of secondary teeth within a torus as seen in our specimens may preclude this as a diagnostic character.

Myriochele oculata Zaks, 1923

Eyes present, agrees with redescription by Blake and Dean (1973).

Myriochele sp. A

Thin, slender species; eyes lacking; tube and methyl green staining pattern similar to that of M. oculata.

PARAONIDAE

Aricidea nr. belgica (Fauvel, 1936)

With short neuropodial postsetal lobes; branchiae broad, blunt-tipped.

Aricidea catherinae Laubier, 1967

The most common paraonid species at our Georges Bank Stations.

Aricidea longobranchiata Day, 1961

New record for eastern North America.

Aricidea lopezi Berkeley & Berkeley, 1956

New record for eastern North America.

Aricidea n. sp. A

Branchiae from setiger 5, continuing over several setigers; setae similar to those of A. suecica, antenna similar to that of A. catherinae. Very similar to Aricidea sp. G.

Aricidea n. sp. B

Median antenna short; branchiae short, rounded; setae with terminal arista as in A. suecica. Near A. claudiae or A. hartmanae.

Aricidea n. sp. C

Median antenna short, clavate; concave sides of modified neurosetae with heavy arista; ciliary bands on prostomium.

Aricidea n. sp. D

Median antenna long, unarticulated; branchiae from setiger 4, similar to those of A. catherinae; modified setae with terminal arista.

Aricidea sp. E

Median antenna short, clavate. Setae and branchiae similar to those of A. wassi. Ciliary band on prostomium. Small dorsal cirrus on setiger 3. May be a juvenile stage of A. wassi.

Aricidea sp. F

Median antenna clavate. Branchiae begin on setiger 4, continue for 13 to 17 setigers, becoming increasingly longer, then shorter for the last two or three setigers of the branchial region. This pattern is similar to that seen in A. catherinae. Modified neurosetae with 2-5 convex hairs on the convex side with 1-? hairs subterminally as in A. finitima or Paraonis fulgens.

Aricidea sp. G

Median antenna similar to that of A. catherinae. Branchiae start on setiger 5, continue for 10-17 setigers. Dorsal lobes flask-shaped in anterior and mid-branchial region, cirriform posteriorly. Modified neurosetae of two types: 1) some similar to those found in A. suecica and 2) one to a few similar to those found in A. catherinae, these not present in anterior postbranchial segments.

Paradoneis n.sp. A

Small species; branchiae lacking.

Paradoneis sp. B

Formerly called Paradoneis lyra in our data set. It differs from P. lyra in that the furcate setae have unequal tines and thick acicular setae are lacking in posterior neuropodia.

Paraonis n. sp. A

With 3 pairs large, broad branchiae (up to 5 on largest specimens); prebranchial region smooth, non-beaded; modified setae sharply hooked with crest and hood.

Paraonis sp. B

Small, threadlike; branchiae from setiger 4; modified neurosetae with long, thick arista.

Paraonis n. sp. C

Similar to P. fulgens. With brush-tipped notosetae among typical capillaries.

Paraonis n. sp. D

Possibly juveniles of A. nr. belgicae.

PHYLLODOCIDAE

Cirrodoce cristata Hartman & Fauchald, 1971

New records; previously known only from single damaged specimen; should be referred to another genus. With 5 antennae and 4 pairs tentacular cirri.

Mystides borealis caeca Langerhans, 1880

Without eyes; otherwise like M. borealis borealis Theel, 1979.

Phyllodoce sp. A

Third tentacular segment with setae; ventral cirri four times as long as setal lobe; solid dark, transverse pigment band on each segment; diagonal rows of papillae on proboscis.

Phyllodoce sp. B

Very close to Phyllodoce sp. A. Differs in that ventral cirri are not as straplike or pointed as those in Phyllodoce sp. A. Ventral cirrus is at most 1.5 times the length of the podial lobe. Proboscis papillae in 6 rows of 10-12 papillae per row. Number of papillae per row decreases ventrally. Two pigment patches on dorsal, anterior end of prostomium.

Phyllodocidae, new genus, new species A

With chitinous proboscidial organs; four pairs tentacular cirri, 4 antennae and nuchal papilla; tapering dorsal cirri.

POLYGORDIDAE

Polygordius sp. A

Small, eyes lacking.

Polygordius sp. B

Eyes present. Tentacles shorter than those of Polygordius sp. A. Found at Sta. 5-28.

PROTODRILIDAE

Protodrilus sp. A

With setae, not Protodriloides chaetifer. Rare.

PSAMMODRILIDAE

Psammodrilus balanoglossoides Swedmark, 1952

Body with 3 regions, including head, thorax, and abdomen; with 3 pairs long dorsal cirri in thorax.

SABELLIDAE

Chone duneri Malmgren, 1867 & C. infundibuliformis Kröyer, 1856

Our specimens may represent the same species; we have no large C. duneri and no small C. infundibuliformis.

Chone sp. A

Staining pattern not as for C. duneri and C. infundibuliformis; collar laterally incised. Abundant at Sta. 14.

Euchone nr. elegans Verrill, 1873

Uncini not exactly as in Banse (1972); variability of forms within tori of abdominal setigers not observed.

Oriopsis sp. A

The most obvious character of this species is the dark "hyphenated" staining pattern along the branchiole ridges. Collar fairly low with several lateral incisions. 8 thoracic setigers, 16 abdominal setigers. Abdominal neurosetae serpuliform with a small tooth at bottom.

Potomilla neglecta (Sars, 1851)

Without tentacular eyes; body ragged, as if poorly preserved.

Sabellidae sp. A

Small. 6-8 pairs of radioles, not united in web, covered with cilia and slightly enlarged at tips, pinnules lacking. 8 thoracic setigers, 3-4 abdominal setigers. Thoracic notosetae spatulate and capillary; thoracic neurosetae long shafted (acicular) hooks. Abdominal notosetae short handled uncini; abdominal neurosetae winged capillaries. First found at Sta. 14A.

SPHAERODORIDAE

Clavodorum sp. A

Same as Spharodoridium sp. A but median antenna different.

Sphaerodoridium sp. A

With 10 rows of dorsal macrotubercles.

Sphaerodoridae sp. A

Twelve rows of macrotubercles, these appear to have a terminal papilla, papilla not as clearly defined as in Sphaerephesia similisetis. Macrotubercles of middle rows smaller than those of other rows. Setae composite. Appear to have 2 pairs of lateral antennae. Two specimens seen, smaller one without antennae and with only six rows of macrotubercles. Found at Sta. 7A.

SPIONIDAE

Malacoceros indicus Fauvel, 1928

Northern range extension.

Polydora barbilla Blake, 1981

New record for eastern North America.

Polydora nr. caeca Oersted, 1843

With posterior spines.

Polydora n.sp. A

Similar to P. flava, but with bundles of posterior notopodial needles occurring in more anterior setigers.

Polydora n.sp. B

In P. socialis group, major spines with apical swelling and terminal mucron.

Polydora n. sp. C

Same species identified as P. caulleryi by Hartman (1965), not Mesnil, 1897. Major spines with crest of bristles and 2 teeth; caruncle broad, triangular shaped. Manuscript describing this species to be submitted to Sarsia.

Prionospio aff. cirrobranchiata Day, 1961

Same as specimens identified as P. cirrobranchiata by Day (1973) from Beaufort, N.C. This species is not identical to P. cirrobranchiata Day, 1961 from South Africa and is being described as a new species (Maciolek, in prep.).

Prionospio n. sp. A

With 8-10 pairs long, broad, apinnate branchiae; prostomium triangular, anteriorly flared. Not P. cirrifera Wiren. Two specimens recorded from Sta. 8.

Prionospio n. sp. B

Prostomium heart-shaped, with medial incision. Neuropodial lamellae of setiger 1 directed anteriorly, lamellae large on setigers 1 and 2; neuropodial lamellae continuing ventrally, forming flap on ventral surface. Hooks multidentate.

Spiophanes sp. A

Prostomium bell-shaped; occipital tentacle absent; eyes absent. May be S. soederstroemi Hartman.

Spionidae new genus, new species A

Prostomium truncate anteriorly, confined posteriorly by a yoke which extends across dorsum between parapodia of setiger 1; branchiae from setiger 3; neuropodial hooded hooks bidentate, notopodial hooks lacking.

Spionidae new genus, new species B

Branchiae from setiger 1, numbering 5 pairs, all pairs apinnate. Hooded hooks multidentate, with at least 2 pairs of apical teeth above main fang.

SYLLIDAE

Amblyosyllis sp. A

Rare, found at Block 410 stations. Blades of compound setae are distinctly serrated, with hooked tips.

Amblyosyllis sp. B

Rare, found at Station 14A. Blades of compound setae are smooth, with hooked tips.

Sphaerosyllis sp. B

Rare, from Sta. 14. Appears to lack antennae.

Streptosyllis sp. A

Extremely small specimens from M-8 site specific stations. Similar to S. arenae in having membranous sheath over tips of blades of compound setae. Differs from S. arenae in having long rather than short falcigerous blades; winged setae are only in anterior setigers.

Syllides cf. articulosa Ehlers, 1897

Recorded in Year I (M1-M4), identification corrected during Year II to S. japonica Imajima, 1966.

Syllides sp. A

Common at Stations 16, 17 and 18. With 1-2 upper simple setae with flared tip, some with serrated edge; blades of compound setae short to long.

Syllides sp. B

Rare, found only at Sta. 14 in Year I (M1-M4). Upper simple setae long, thin, whiplike.

Syllides sp. C

Rare, found at Stations 5-8 and 17. Upper simple setae serrated, with bifid tip.

Syllides sp. D

Rare, found at Sta. 8. Upper simple setae long, pointed, present in posterior setigers; median dorsal cirri not articulated.

TEREBELLIDAE

Polycirrus sp. A

With 8-12 thoracic setigers; uncini begin on setigers 7-8; with 7-8 (10) pairs ventral shields.

Polycirrus sp. B

With 19 thoracic setigers; uncini begin on setiger 16.

Polycirrus sp. D

With 18 thoracic setigers; uncini begin on setiger 11-12, 16 pairs of ventral shields visible when stained.

Polycirrus sp. E

With 18 thoracic setigers; uncini begin on setiger 9; approximately 13 pairs of ventral shields visible when stained. May be smaller stage of Polycirrus sp. D.

Polycirrus sp. F

With 13-18 thoracic setigers, uncini begin on setiger 9-12, 8-10 pairs of ventral shields visible when stained; distinct plumose notosetae.

Polycirrus sp. G

Stained shields look like elevated blocks. Does not stain like other Polycirrus. With 11 thoracic setigers; uncini begin on setiger 12; 7 pairs of ventral shields visible when stained.

Polycirrus sp. H

With 16 thoracic setigers; uncini begin on setiger 9; 13 pairs of ventral shields visible when stained.

Polycirrus sp. I

With 7 thoracic setigers; with 2 elevated ventral ridges anteriorly, which merge into one unelevated, noticeable stripe posteriorly; notosetae barely extend beyond end of parapodia; only one bundle of neurosetae seen on entire specimen. Does not stain with methyl green.

Proclea sp. A

With 13-16 thoracic setigers; uncini begin on setiger 3, double rows of uncini begin on setiger 8. Dentate setae begin on setiger 9-10. Complete specimens with more than 24 abdominal setigers. 10 pairs of ventral shields visible when stained. Ovigerous specimens found.

Streblosoma sp. A

With eighteen thoracic setigers. Three setigers with branchiae. Notosetae start on first branchial segment. Uncini with main fang, 3-4 teeth in secondary row and 4-5 teeth in top row, papillae on base of uncini. Capillaries rough, irregularly jointed at tips, possibly infected or damaged.

Thelepinae n. sp. A

With first 5 setigers bearing filamentous branchiae; notosetae present from segment 2; uncini present from setiger 6. Closest to genus Streblosoma. One specimen from Sta. 6.

TRICHOBRANCHIDAE

Terebellides stroemi Sars, 1835

Juveniles with transitional setal arrangement; geniculate setae of setiger 6 in adults also occur in setigers 4-5 in juveniles, thus sharing characters of other genera.

TROCHOCHAETIDAE

Trochochaeta nr. carica (Birula, 1897)

One specimen from Sta. 14 collected in Year I. Differs from T. carica in that there is no caruncle on the prostomium, and the noto- and neuropodial lamellae are digitiform, not rounded.

POLYCHAETA INDETERMINATE

Polychaeta sp. A

Very small polychaete with uniramous (?) parapodia. Setae include simple and unusual compound types. Appears to have 2 ventral antennae. Appears to have a muscular pharynx. Short dorsal cirri present. First found at Sta. 5-22 and 5-28.

Polychaeta sp. B

Only one very small specimen from Sta. 5-8. Pair of palps inserted dorsolaterally on prostomium. Parapodia appear biramous; setae all capillaries. Large ventral cirrus(?) on some segments. Annulated segments.

ANNELIDA: OLIGOCHAETA

Changes in the species identifications of the polychaetes are based on correspondence with Dr. Christer Erséus of the University of Goteborg, who has examined a voucher collection of all species identified.

TUBIFICIDAE

Adelodrilus sp. A

This taxon was determined to represent a mixture of Adelodrilus sp. A and A. multispinosus. Adelodrilus sp. A is very similar to A. multispinosus except that the giant penial setae are not hooked distally and are more spoon-shaped, the medium penial setae have tiny spines on the distal end, and the posterior somatic setae are longer and more sharply pointed.

Adelodrilus n. sp. B

This was called Tubificidae sp. A in the Year I report. It has now been identified as a new species of the genus Adelodrilus. It has distinctly spoon-shaped giant penial setae, accompanied by several smaller, straight, simple pointed penial setae. The ventral somatic setae of segments IX and X are modified and approximately twice as long as other somatic setae and have simple points, while other somatic setae are bifid. Posterior somatic setae with upper tooth very small, but never simple, pointed.

Bathydrilus longus

Formerly called Tubificidae sp. B.

Heterodrilus occidentalis

Called Clitellio arenicolus in the Year I report. Generally identified by its characteristic setal pattern and the very small lower tooth on the posterior somatic setae.

Peosidrilus biprostratus

Identified as Phallodrilus coeloprostratus in the Year I report. With somatic and penial setae nearly identical to those of P. coeloprostratus. The main difference is that P. biprostratus has a large hollow penis where P. coeloprostratus does not have a penis. P. biprostratus is also slightly larger overall.

Phallodrilus tenuissimus

Formerly called Tubificidae sp. D.

Phallodrilus n. sp. A

This was called Phallodrilus coeloprostratus in the Year I report. It has since been determined to be a new species of the genus Phallodrilus (Erséus, personal communication). It is very small with penial setae similar to those of P. coeloprostratus in number and shape but smaller. Posterior somatic setae are strongly sigmoid with a large angle between the teeth.

Tubificoides n. sp. A

Called Limnodriloides medioporus in the Year I report. Somatic setae all bifid; anterior setae in bundles of up to seven, posterior setae in bundles of two or three. Narrow, very slender cuticular penis sheaths. Small stalked prostrate glands. Long, straight atrium with vas deferens about twice the length of atrium.

Uniporodrilus n. sp. A

This was called Phallodrilus obscurus in the Year I report. It has six large penial setae with strongly hooked distal ends and bifid somatic setae, both very much like those of P. obscurus. It has a large, unpaired atrium into which both vas deferens run. One penial bundle is located at the male pore and the other penial bundle is located on the other side of the body.

Oligochaeta n. fam. sp. A

This was formerly called Tubificidae sp. H. It is now thought to represent a new family of Oligochaeta (Erséus, personal communication). It has penial setae that are very thin and longlike hair setae. There may be up to three pairs of penial setae, each pair on a different segment. Normally only one pair of penial setae with modified ventral somatic setae on the segments immediately anterior and posterior to the penial setae. Somatic setae very small, include sigmoid and simple pointed setae in bundles of three anteriorly and two posteriorly.

Tubificoides apectinatus and Tubificoides intermedius

Formerly in the genus Peloscolex, which has been synonymised with the genus Tubificoides.

ENCHYTRAEIDAE

Grania n. sp. A

Identified as Grania postclitellochaeta in the Year I report. Simple somatic setae with club-shaped root.

Grania n. sp. B

Identified as Lumbricillus codensis in the Year I report. Simple somatic setae with hook-shaped root.

Grania n. sp. C

Formerly Enchytraeidae sp. A. No somatic setae of any kind.

The Grania problem is currently being worked out by Dr. Christer Erséus and Ms. Kathryn Coates (C. Erséus personal communication). Until these problems are resolved, species designations are tenuous.

MOLLUSCA: GASTROPODA

PROSOBRANCHIA

Alvania cf. acuticostata (Dall, 1889)

A single sub-adult specimen whose nucleus shows it to be the same as Gastropod sp. B. If identification is correct, this would be a range extension from Cape Hatteras, N.C.

Alvania exarata Stimpson, 1831

Preferred name for A. arenaria Mighels & Adams 1842, which was recorded in the Georges Bank Benchmark study.

Epitonium dallianum Verrill & Smith, 1880

This uncommon gastropod has been found in several samples and is a range extension from its type locality 175 miles off Ashbury Park, N.J. and 85 miles south of Martha's Vineyard.

Mitrella dissimilis Stimpson, 1851

Listed as a synonym for M. lunata in Abbott (1974), yet the two are different and should be maintained as separate species.

Onchidoris cf. tenella Gould, 1870

A single adult specimen with conical dorsal papillae. The specimen was distorted during preservation, making identification difficult.

Philine tincta Verrill, 1882

Single adult specimen. Previous reports give its range as "off Martha's Vineyard", the type locality.

Turritellopsis cf. acicula (Stimpson, 1851)

Represented by only a few badly preserved specimens. Enough of the shell sculpture is preserved in the remaining periostracum to suggest this species.

Gastropod sp. C

A single, poorly preserved specimen that resembles a very small Naticid except that it is sinistral instead of dextral.

Naticidae sp. A

Juvenile specimens not readily assignable to any species.

OPISTOBRANCHIA

Doridella obscura Verrill, 1870

Several specimens were found at Station 15, constituting a slight range extension from the Vineyard Sound. Also, this species is normally found in bays and estuaries from the intertidal to 7.7 meters, therefore this record is also a depth extension.

Eubranchus sp. A

This designation is used for certain juvenile nudibranchs which lack sufficient adult characters for certain species identification. This may be E. pallidus (Alder & Hancock, 1842) whose range extends to Georges Bank.

Aeolididae sp. A

A single adult specimen, having oblique leaflets on rhinophores. General appearance suggests Cerberilla tanna Marcus & Marcus 1959, known from Texas.

Nudibranchia sp. B

A single juvenile nudibranch specimen, not readily assignable to any family.

Nudibranch sp. C

A single juvenile specimen. It has an oval velum, rhinophores not retracted into sheaths, and a single, longitudinal row of cerata on either side of the body.

MOLLUSCA: BIVALVIA

Crenella fragilis Verrill, 1885

Represented by two specimens from Station 12. This is a range extension from off the coast of Wachapreague, Virginia.

Diplodonta sp. A

Several broken specimens, shape of shell and presence of a bifid tooth suggest this genus.

Leptonacea sp. B

Single broken specimen; a small obese bivalve with wrinkled redish-brown periostracum.

Mysella planulata (Stimpson, 1857)

Name given to the few, minute bivalves formerly referred to as Leptonacea sp. A.

Palliolum sp. B

A small scallop with rounded byssal notch and differing sculpture on opposite valves, very small specimens resemble juvenile Placopecten magellanicus, as figured in Merrill (1961), yet cannot be identified as such until juvenile stages of Palliolum have been studied.

Tellina agilis Stimpson, 1857

This bivalve is the dominent mollusc at several stations. We have not collected specimens as large as those found in shallower water. All our specimens exhibit shell sculpture of slightly raised concentric lines which appear to be a juvenile character, as they can be found on the older parts of the shells of specimens from Boston Harbor. These lines are not mentioned in this species description in Boss's (1968) monograph on Western Atlantic Tellinidae.

Thyasira spp. A-E

A confused genus needing monographic revision. There are many species found in our area and some of these have several forms. Thyasira sp. A resembles T. trisinuata; sp. B resembles T. flexuosa; sp. C could be T. pygmaea, although our stations are shallow for that species, or a juvenile form of a different Thyasira species. Thyasira sp. D and E do not closely resemble any described species.

MOLLUSCA: SCAPHOPODA

Siphonodentalium cf. tythum Watson, 1879

A small scaphopod with small apex and large aperture; fragile apex features required for proper identification broken on our specimens. If identification is correct, it consitutes a range extension from the Caribbean.

MOLLUSCA: POLYPLACOPHORA

Hanleya sp. A

Small, poorly preserved chitons whose girdle scales suggest this genus.

Leptochiton sp. A

A small chiton whose characters suggest L. cancellatas. Dr. Robert Bullock of the University of Rhode Island (personal communication) prefers the generic name Leptochiton to Lepidopleuras as given in Abbott (1974).

Leptochiton sp. B

A small poorly preserved specimen which lacks the valve sculpture of Leptochiton sp. A.

MOLLUSCA: APLACOPHORA

Neomeniomorpha spp. A - E

Animals which do not fit the descriptions in Heath's (1918) monograph on Western Atlantic solenogasters. Neomeniomorpha sp. A is probably in the subclass Chaetodermomorpha, the first specimens we saw were damaged and small.

ARTHROPODA: CRUSTACEA

PYGNOGONIDA

Anoplodactylus sp. A

Rare, a larval stage which is almost certainly A. lentus Wilson, 1878.

CUMACEA

Campylaspis sp. A

A juvenile, probably Campylaspis affinis Sars, 1870.

Diastylis lucifera (Kroyer, 1841)

Georges Bank specimens represent a southern range extension. The previously reported range was from Nova Scotia to the Gulf of Maine (Watling, 1979).

Diastylis sp. A

A juvenile with telson having two apical spines and two pairs of marginal spines. Caparace smooth.

Diastylis sp. B

Similar to Diastylis goodsiri (Bell, 1855), but has no plumose setae on peduncle of antennae.

Diastylis sp. C

Rare; represented by one large male which is similar to Diastylis rathkei (Kroyer, 1841) except for differences in the number of segments of the exopods and endopods.

Lamprops sp. A

Rare. Juvenile specimens, probably L. quadriplicata S.I. Smith, 1879.

Leptostylis sp. A

A juvenile, probably Leptostylis longimana (Sars, 1865).

TANAIDACEA

Pseudoleptochelia filum (Stimpson, 1853)

With distinctively pigmented eyes. Has been sent to Dr. Jurgen Sieg at Universitat Osnabruck, West Germany for confirmation.

Tanaissus lilljeborgi (Stebbing, 1871)

The most common tanaid in our Georges Bank samples; also common in BLM samples from the Mid-Atlantic Bight. Has been sent to Dr. Jurgen Sieg for confirmation.

Typholotanais nr. cornutus G. O. Sars, 1885

Identified by Isabelle Williams (W.H.O.I.) following Lang (1970). It has been collected from Norway and the Davis Strait. Has been sent to Dr. Jurgen Sieg for confirmation.

ISOPODA

Aselloidea sp. H

Rare. Manca stage (approximately 1 mm). Shaped like a Cirolana with 2 darkly pigmented eyes, antennae which extend laterally, and two minute terminal uropods.

Cryptoniscidae sp. A

Rare. Represented by one male specimen only. Most similar to Liriopsis.

Desmosomatidae

Rare. Probably Desmosoma tenuimanum (G.O. Sars, 1899).

Eurycope mutica (G.O. Sars, 1863)

Rare. Georges Bank specimens represent a southern range extension. Previous range is reported to be from Norway to the Bay of Fundy (9 to 27 m) (Shultz, 1969).

Janira sp. A

Rare. Juvenile, probably J. alta.

Munna fabricii (Kröyer)

Georges Bank specimens represent a southern range extension. Shultz (1969) reported the range from Greenland to Maine.

Munna sp. B

Rare. Similar to Munna kroyeri Goodsir (1842), with slightly stalked eyes and uropods on the pleotelson. However, no lateral spines are on the pleotelson. Total length is approximately 1 mm.

Munnidae sp. A

Rare. Small black eyes visible dorsally. The last peraeonal segment is narrower than the telson. Antennae 1 and 2 are very short.

Edotea triloba (Say, 1818)

It is very difficult to distinguish between Edotea triloba and E. montosa. Dr. Les Watling of the University of Maine (personal communication) has identified our specimens as E. triloba, since he believes E. montosa is not a valid species.

Edotea sp. B

Juvenile, probably Edotea triloba.

Paramunna sp. A

Rare. Similar to Parmunna bilobata G.O. Sars 1865, except the lateral projections of the anterior peraeonal segments are long and acute, not truncated as in P. bilobata.

Pleurogonium inerme (Sars)

Georges Bank specimens represent a southern range extension. Shultz (1969) reported this species from relatively shallow water (4 to 27m) in the Bay of Fundy.

Ptilanthura tricarina Menzies and Frankenberg, 1966

Georges Bank specimens represent a northern range extension according to range given by Menzies and Frankenberg (1966).

Ptilanthura sp. A

Rare. Juvenile, probably P. tricarina Menzies & Frankenberg, 1966.

AMPHIPODA

Paramphilochoides sp. A

Rare. Juvenile, probably P. odontonyx.

Byblis sp. A

Represented by one small specimen similar to Byblis gaimardi (Kröyer, 1846).

Unciola spp. juveniles

First and second instar individuals, not having adult characteristics. Most have been found with adult Unciola inermis.

Siphonoecetes colleti (Myers & McGrath, 1979)

A synonym of S. smithianus Rathbun, 1905.

Bathyporeia quoddyensis Shoemaker, 1949

These specimens lack spines on the inner margins of the telson, therefore, Watling (personal communication) believes they are Bathyporeia parkeri Bousfield, 1973. However, other morphological characters as well as the ecology coincide with B. quoddyensis. Bousfield (1973) reported that B. parkeri occurs on exposed sandy beaches, from just below the breaker zone to 10 m, whereas B. quoddyensis occurs subtidally to more than 40 m. The posterior margin of peraeopod 7 is oblique (not sharply incised, as in B. parkeri) and lacks spines (not 4-5 spines as in B. parkeri). Peraeopod 7 looks like the drawing in Shoemaker (1949) and fits the key characters of Bousfield (1973). Epimeral plates 1 and 2 do not have the posterior margin proximally produced into a sharp tooth as described and illustrated in Bousfield (1973) for B. parkeri. The eye, when pigmented, has four pigmented facets, not 6 like B. parkeri.

Ischyrocerus sp. A

Juveniles, probably the same as Ischyrocerus sp. B.

Ischyrocerus sp. B

Fits within very broad concept of Ischyrocerus anguipes Kröyer 1838, in which epimeral side plate 3 rounded; telson acute with 2 clumps of spines; spines present on peduncle of uropod 3. However, outer ramus of uropod 3 bears 7-8 blunt denticles, not 4-5 as noted in Bousfield (1973). Our specimens quite similar to Ischyrocerus sp. T-1 (Just, 1980).

Anonyx sp. A

Juveniles, probably Anonyx sarsi Steel and Brunel, 1968.

Lysiannasidae sp. A

Represented by a few small specimens which are most similar to Anonyx sarsi Steel and Brunel, 1968. Sent to Dr. Watling for verification.

Lysianassidae sp. B

Represented by a few specimens, are similar to Psammonyx noblis (Stimpson, 1853). Sent to Dr. Watling for verification.

Lysianassidae sp. C

Rare. Most similar to Orchomenella (Orchomene) groenlandica.

Orchomene sp. A

Rare. Juvniles, probably O. minuta (Kröyer, 1842).

Melitidae sp. B

Rare. Juveniles, uropod 3 has 2 long rami. No tooth on epimeral plate 3. Possibly Maera loveri (Bruzelius, 1859).

Oedioceridae sp. A

Rare. Keys to Westwoodilla in Bousfield (1973).

Monoculodes sp. A

Similar to drawing of Monoculodes edwardsi in Bousfield (1973). Carpal lobe on gnathopod 2 is about 1/3 the length of propodus, and not touching dactyl.

Monoculodes sp. D

Rare. Small specimen (approximately 2 mm) in which gnathopod 2 lacks a conspicuous carpal lobe. Similar to M. mertensi.

Monoculodes sp. E

Rare. It is the same as Monoculodes sp. A listed in Watling, 1979. Gnathopod 1 has a broad, short carpal lobe. Gnathopod 2 has an acute, short carpal lobe, not extending to the palmer angle. Similar to M. caecus.

Monoculodes edwardsi Holmes, 1905

Most of our Monoculodes are M. edwardsi as described by Holmes (1905). First segment of antenna 1 as long as the next two segments; gnathopod 2 with a long, slender carpal lobe, extending slightly more than 1/2 length of propodus and meeting dactyl.

Photis pollex (Walker, 1895)

A synonym of Photis macrocoxa as noted by Myers and McGrath (1981).

Gammaropsis nitida (Stimpson, 1853)

A synonym of Podoceropsis nitida as noted by Barnard (1973).

Photidae sp. A

Rare. Represented by a few juvenile, damaged specimens.

Pleustidae sp. A

Rare. Approximately 4 mm total length. No accessory flagellum on antenna 1. Telson entire with length equal to width. Gnathopod 1 small, gnathopod 2 very large.

Rhachotropis inflata G.O. Sars, 1882

Georges Bank specimens represent a southern range extension. The previously reported range was north of latitude 42° on the Continental Shelf and Slope (Watling, 1979).

Rhepoxynius hudsoni Barnard and Barnard, 1982

A synonym of Rhepoxynius epistomus as described by Bousfield (1973) according to Barnard and Barnard, 1982.

Dyopedos monacanthus (Metzger, 1875)

A synonym of Dulichia monacantha according to Laubitz (1977).

Stenothoidae

The species of this family have been identified primarily on the basis of body parts. Mouth parts have not been used, except occasionally when there were several large specimens of the same species in a sample. More detailed taxonomic work is necessary on this family.

DECAPODA

Axiidae sp. A

Similar to Axis serratus Stimpson, 1852.

Axiidae sp. B

Similar to Calocaris tempelmani Squires, 1965.

Galatheidae sp. A

Rare. Juveniles, probably Munida iris.

ECTOPROCTA

Eucratea loricata (L., 1758)

Most common bryozoan.

ECHINODERMATA: ECHINOIDEA

Echinocardium flavescens (Muller)

Verifies occurrence on east coast of North America, which was questioned by Mortensen (1927).

Echinoidea juvenile sp. A

Probably juvenile Echinarachnius parma (Lamarck, 1816); ambulacral petaloid not developed; periproct aboral or not developed.

Echinoidea juvenile sp. B

A regular echinoderm; lacking adult characteristics.

Echinoidea juvenile sp. C

Possibly a decalcified specimen of Echinoidea juvenile sp. A

ECHINODERMATA: OPHIUROIDEA

Amphitarsus spinifer Schoener, 1967

8 mm disc diameter; genital clefts partioned superficially by 4-5 overlapping plates as opposed to two overlapping plates in holotype (Schoener, 1967).

Ophiuroidea juvenile sp. A

Probably juvenile Amphipolis squamata (Delle Chiaje, 1828); 4-8 arm segments; mouth parts not fully developed; tentacle scales not developed; radial shields reduced.

Ophiuroidea juvenile sp. B

Mouth parts minimally developed; 1-3 arm segments.

Ophiuroidea sp. E

Possibly juvenile Amphitarsus spinifer Schoener, 1967; lacking adult characteristics.

Ophiuroidea sp. F

Determined to be juvenile forms of various species in which all arm plates, dorsal scales and radial shields were decalcified.

Ophiuroidea juvenile sp. G

Probably juvenile Amphioplus abditus (Verrill, 1871); adult characteristics lacking.

Ophiuroidea juvenile sp. H

Probably juvenile Ophiura robusta (Ayres, 1851); adult characteristics lacking.

ECHINODERMATA: ASTEROIDEA

Forcipulata juvenile sp. B

Probably also juvenile Leptasterias tenera (Stimpson, 1862); adult characteristics lacking.

Leptasterias tenera juvenile sp. A

Attached to adult Leptasterias tenera (Stimpson, 1862) or with remnant attachment strands; adult characteristics lacking.

Paxillosida juvenile sp. A

Probably juvenile Astropecten americanus Verrill, 1880. Adult characteristics lacking.

Asteroidea juvenile sp. D

Possibly juvenile Astropecten americanus Verrill, 1880; some evidence of initial formation of marginal plates.

HEMICHORDATA: ENTEROPNUESTA

Enteropnuesta sp. A,B,D,E,F,G.

All small, separated into different species by shape of proboscis.

SYSTEMATIC LITERATURE CITED

Abbott, R.T. 1974. American Seashells. 2nd Edition. Van Nostrand Reinhold Co., NY 663 pp.

Arwidsson, I. 1907. Studien uber die skandinavischen und arktischen Maldaniden nebst Zusammenstellung der ubrigen bisher behannten Arten dieser Familie. Zool. Jahrb. Suppl., 9:1-308.

Banse, K. 1972. Redescription of some species of Chone Kröyer and Euchone Malmgren, and three new species (Sabellidae, Polychaeta). Fishery Bull. 70(2):459-495.

Barnard, J.L. 1973. Revision of Corophiidae and related families (Amphipoda). Smithsonian Contr. Zool. 151:1-27.

Barnard, J.L. and C.M. Barnard. 1982. The genus Rhepoxynius (Crustacea: Amphipoda: Phoxocephalidae) in American seas. Smithonian Contr. Zool. 357:1-49.

Blake, J.A. and D. Dean. 1973. Polychaetous annelids collected by the R/V Hero from Baffin Island, Davis Strait, and West Greenland in 1968. Bull. Sthn. Cal. Acad. Sci. 72(1):31-39.

Boss, K.J. 1968. The Subfamily Tellininae in the Western Atlantic. The genus Tellina (Part II) and Tellidora. Johnsonia 4(46):273-344.

Bousfield, E.L. 1973. Shallow-water gammaridean Amphipoda of New England. Cornell University Press, Ithaca, NY 312 pp.

Day, J.H. 1973. New polychaeta from Beaufort, with a key to all species recorded from North Carolina. NOAA Tech. Rept. NMFS Circ.-375. 140 pp.

Gardiner, S. 1976. Errant polychaete annelids from North Carolina. J. Elisha Mitchell Sci. Soc. 91(3):77-220.

Grassle, J.F. and J.P. Grassle. 1977. Temporal adaptations in sibling species of Capitella. In: B.C. Coull (Ed.) Ecology of Marine Benthos. Belle W. Baruch Library in Marine Science No. 6. Univ. South Carolina Press. pp. 177-190.

Hartman, O. 1965. Deep-water benthic polychaetous annelids off New England to Bermuda and other North Atlantic areas. Allan Hancock Fdn. Publ. Occ. Pap. 28, 378 pp.

Heath, H. 1918. Solenogasters from the east coast of North America. Mem. Mus. Comp. Zool. 45:9-179.

Holmes, S.J. 1905. The Amphipoda of southern New England. Bull. U.S. Bur. Fish. 24:457-529.

Imajima, M. and Y. Shiraki. 1982. Maldanidae (Annelida: Polychaeta) from Japan (Part 2). Bull. Nat. Sci. Mus. 8(2):47-88.

Just, J. 1980. Amphipoda (Crustacea) of the Thule area, northwest Greenland: Faunistics and taxonomy. Greenland Bioscience 2:1-64.

Lang, K. 1970. Taxonomische und phylogenetische untersuchungen uber die Tanaidaceen, 5. Die Gattung Thyplotanais G.O. Sars, 1882 nebst Beschreibung Einer Neuen Art dieser Gattung, Dazu Eine Berichtigung der Dornenzahl des Enditen der Maxillulae Bei. I. pecularis Lang, 1968. Ark. Zool., 2(23):267-291.

Laubitz, D.R. 1977. A revision of the genera Dulichia Kroyer and Paradulichia Boeck (Amphipoda, Podoceridae). Can. Jour. Zool. 55:942-982.

Menzies, R.J. and D. Frankenberg. 1966. Handbook on the Common Marine Isopod Crustacea of Georgia. U. of Georgia Press, Athens, GA. 93 pp.

Merrill, A.S. 1961. Shell morphology in the larval and postlarval stages of the sea scallop, Placopecten magellanicus. Bull. Mus. Comp. Zool. 125(1):1-19.

Mortensen, T. 1927. Handbook of the Echinoderms of the British Isles. London. Oxford University Press. 471 pp.

Myers, A.A. and D. McGrath. 1979. The British and Irish species of Siphonoecetes Kroyer (Amphipoda-Gammaridea). J. Nat. Hist. 13(2):211-220.

Pettibone, M.H. 1963. Marine polychaete worms of the New England region. 1. Families Aphroditidae through Trochochaetidae. Bull. U.S. Nat. Mus. 227:356 pp.

Schoener, A. 1967. Two new species of Amphitarsus (Ophiuroidea) from the western North Atlantic. Breviora 269: 1-9.

Shoemaker, C.R. 1949. Three new species and one new variety of amphipods from the Bay of Fundy. J. Wash. Acad. Sci. 39:389-398.

Schultz, G.A. 1969. The Marine Isopod Crustaceans. Wm. C. Brown Co. Publ., Dubuque, Iowa. 359 pp.

Steele, D.H. and P. Brunel. 1968. Amphipoda of the Atlantic and Arctic coasts of North America: Anonyx (Lysianassidae). J. Fish. Res. Board Can. 25:943-1060.

Støp-Bowitz, C. 1958. (New polychaetes from Norway). Sciencaj Studoj Kopenhago pp. 213-216 (In Norwegian, French resume).

Warren, L.M. 1979. Mediomastus fragilis Rasmussen (Polychaeta: Capitellidae), a species newly recorded from British waters. J. mar. biol. Ass. U.K. 59:757-760.

Watling, L. 1979. Zoogeographic affinities of northeastern North American Gammaridean Amphipoda. Bull. Biol. Soc. Wash. 3:256-282.

APPENDIX D

TABLE D-1. RESULTS OF CHN ANALYSIS FROM GEORGES BANK BENTHIC MONITORING PROGRAM REGIONAL STATIONS. SOME SAMPLES NOT COLLECTED ON M7 DUE TO POOR WEATHER CONDITIONS.

		M-5			M-6			M-7			M-8		
Sta.	Rep.	%C	%H	%N	%C	%H	%N	%C	%H	%N	%C	%H	%N
1	1	0.05	0.02	0.00	0.03	0.03	0.00	0.07	0.04	0.00	0.08	0.03	0.01
	2	0.03	0.01	0.00	0.02	0.01	0.01	0.03	0.02	0.00	0.03	0.02	0.00
	3	0.03	0.01	0.00	0.02	0.02	0.00	0.03	0.02	0.00	0.04	0.02	0.00
	4	0.03	0.01	0.00	0.03	0.02	0.00	0.04	0.02	0.00	0.03	0.02	0.00
	5	0.03	0.01	0.00	0.03	0.02	0.00	0.05	0.02	0.00	0.04	0.02	0.00
	6	0.06	0.02	0.00	0.37	0.02	0.00	0.05	0.02	0.00	0.03	0.02	0.00
2	1	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.01	0.00	0.01	0.00	0.00
	2	0.03	0.01	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.02	0.01	0.00
	3	0.03	0.00	0.00	0.01	0.01	0.00	0.06	0.01	0.00	0.02	0.01	0.00
	4	0.02	0.01	0.00	0.03	0.01	0.00	0.03	0.01	0.00	0.03	0.01	0.00
	5	0.03	0.01	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.00	0.00
	6	0.03	0.01	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.03	0.01	0.00
3	1	0.26	0.04	0.01	0.50	0.05	0.01	0.13	0.04	0.01	-	-	-
	2	0.21	0.05	0.03	2.38	0.14	0.02	0.40	0.03	0.01	0.24	0.03	0.02
	3	0.06	0.01	0.00	3.54	0.12	0.01	-	-	-	0.42	0.05	0.01
	4	0.18	0.03	0.01	0.10	0.02	0.01	0.60	0.06	0.01	3.24	0.12	0.02
	5	0.48	0.05	0.02	0.13	0.04	0.01	0.16	0.03	0.01	0.29	0.06	0.01
	6	0.07	0.02	0.01	0.70	0.06	0.00	0.16	0.03	0.00	2.75	0.09	0.01
4	1	0.09	0.03	0.01	0.06	0.03	0.01	-	-	-	0.11	0.04	0.01
	2	0.09	0.03	0.00	0.07	0.02	0.01	-	-	-	0.07	0.03	0.01
	3	0.08	0.03	0.01	0.07	0.03	0.00	-	-	-	0.07	0.03	0.00
	4	0.09	0.03	0.00	0.07	0.03	0.00	-	-	-	0.07	0.03	0.01
	5	0.08	0.03	0.00	0.07	0.03	0.00	-	-	-	0.07	0.03	0.01
	6	0.09	0.04	0.00	0.08	0.03	0.00	-	-	-	0.07	0.03	0.01
6	1	0.16	0.03	0.01	0.18	0.04	0.02	0.12	0.04	0.00	0.17	0.04	0.02
	2	0.08	0.02	0.00	0.16	0.04	0.02	0.13	0.05	0.02	0.21	0.05	0.01
	3	0.13	0.02	0.00	0.11	0.03	0.01	0.12	0.04	0.01	0.08	0.03	0.01
	4	0.14	0.03	0.01	0.19	0.04	0.03	0.17	0.04	0.01	0.12	0.04	0.01
	5	0.11	0.02	0.00	0.15	0.04	0.01	0.15	0.04	0.02	0.21	0.05	0.02
	6	0.14	0.03	0.01	0.23	0.06	0.02	0.16	0.04	0.01	0.15	0.05	0.01

TABLE D-1. (Continued)

Sta. / Rep.		M-5 %C	M-5 %H	M-5 %N	M-6 %C	M-6 %H	M-6 %N	M-7 %C	M-7 %H	M-7 %N	M-8 %C	M-8 %H	M-8 %N
7A	1	1.01	0.28	0.10	0.63	0.22	0.10	0.47	0.16	0.06	1.05	0.29	0.11
	2	0.88	0.24	0.08	0.88	0.27	0.11	0.40	0.14	0.05	1.02	0.27	0.10
	3	0.65	0.19	0.07	0.60	0.19	0.08	0.70	0.21	0.08	0.67	0.22	0.07
	4	0.53	0.17	0.04	0.66	0.21	0.07	0.48	0.17	0.06	0.67	0.21	0.07
	5	0.68	0.18	0.06	0.67	0.21	0.08	0.63	0.21	0.07	0.59	0.19	0.06
	6	0.59	0.19	0.05	0.88	0.28	0.10	0.57	0.18	0.06	0.59	0.19	0.07
8	1	0.06	0.03	0.00	0.09	0.03	0.01	0.06	0.03	0.00	0.11	0.03	0.00
	2	0.07	0.02	0.00	0.10	0.03	0.01	0.09	0.04	0.00	0.09	0.04	0.01
	3	0.03	0.01	0.00	0.12	0.04	0.00	0.11	0.04	0.00	0.13	0.05	0.00
	4	0.07	0.02	0.00	0.12	0.04	0.00	0.12	0.04	0.00	0.10	0.04	0.01
	5	0.08	0.02	0.00	0.19	0.05	0.01	0.06	0.03	0.00	0.12	0.04	0.00
	6	0.09	0.03	0.00	0.08	0.03	0.00	0.11	0.04	0.00	0.24	0.06	0.02
9	1	0.08	0.03	0.00	0.11	0.05	0.01	-	-	-	0.09	0.04	0.01
	2	0.10	0.04	0.02	0.12	0.04	0.01	-	-	-	0.10	0.04	0.01
	3	0.07	0.02	0.01	0.08	0.03	0.01	-	-	-	0.11	0.04	0.01
	4	0.07	0.02	0.00	0.11	0.04	0.01	-	-	-	0.11	0.04	0.01
	5	0.05	0.02	0.00	0.10	0.04	0.01	-	-	-	1.38	0.05	0.01
	6	0.08	0.03	0.02	0.08	0.03	0.01	-	-	-	0.16	0.05	0.01
10	1	0.07	0.03	0.00	0.03	0.01	0.00	0.04	0.02	0.00	0.05	0.02	0.00
	2	0.05	0.01	0.00	0.06	0.02	0.01	0.02	0.01	0.00	0.03	0.01	0.00
	3	0.10	0.02	0.00	0.03	0.02	0.00	0.04	0.02	0.00	0.04	0.02	0.00
	4	0.05	0.02	0.00	0.04	0.02	0.00	0.04	0.02	0.00	0.05	0.02	0.01
	5	0.13	0.03	0.00	0.13	0.04	0.00	0.05	0.01	0.00	0.10	0.03	0.01
	6	0.08	0.02	0.00	0.03	0.02	0.00	0.01	0.01	0.00	0.04	0.02	0.00
11	1	0.18	0.06	0.02	0.31	0.08	0.03	-	-	-	0.21	0.06	0.03
	2	0.24	0.07	0.03	0.13	0.06	0.01	-	-	-	0.16	0.06	0.02
	3	0.14	0.06	0.01	0.17	0.07	0.02	-	-	-	0.18	0.06	0.02
	4	0.18	0.06	0.01	0.18	0.07	0.02	-	-	-	0.23	0.07	0.03
	5	0.17	0.06	0.01	0.15	0.06	0.02	-	-	-	0.23	0.07	0.02
	6	0.15	0.05	0.00	0.16	0.06	0.01	-	-	-	0.15	0.05	0.01
12	1	0.15	0.04	0.00	0.14	0.04	0.01	-	-	-	0.20	0.06	0.02
	2	0.07	0.03	0.00	0.20	0.06	0.03	-	-	-	0.22	0.06	0.02
	3	0.08	0.02	0.00	0.11	0.03	0.01	-	-	-	0.19	0.06	0.02
	4	0.09	0.02	0.01	0.34	0.09	0.06	-	-	-	0.11	0.03	0.01
	5	0.19	0.05	0.01	0.21	0.06	0.03	-	-	-	0.18	0.06	0.02
	6	0.10	0.03	0.00	0.21	0.06	0.02	-	-	-	0.20	0.06	0.02

TABLE D-1. (Continued).

Sta. / Rep.		M-5 %C	M-5 %H	M-5 %N	M-6 %C	M-6 %H	M-6 %N	M-7 %C	M-7 %H	M-7 %N	M-8 %C	M-8 %H	M-8 %N
13	1	1.40	0.36	0.22	0.91	0.24	0.12	0.72	0.16	0.09	0.64	0.16	0.07
	2	0.91	0.24	0.12	0.80	0.22	0.10	0.67	0.18	0.08	0.67	0.19	0.08
	3	0.96	0.24	0.12	1.16	0.29	0.16	0.61	0.17	0.07	1.03	0.27	0.13
	4	0.88	0.25	0.11	0.82	0.23	0.11	0.72	0.19	0.09	0.61	0.17	0.08
	5	1.40	0.28	0.13	1.03	0.28	0.15	0.77	0.21	0.10	0.85	0.23	0.11
	6	0.99	0.27	0.12	0.72	0.21	0.10	0.76	0.21	0.09	1.09	0.28	0.15
13A	1	2.13	0.55	0.26	1.89	0.51	0.24	-	-	-	1.79	0.43	0.23
	2	1.99	0.53	0.24	2.07	0.56	0.26	-	-	-	2.18	0.56	0.28
	3	2.02	0.49	0.25	1.87	0.50	0.22	-	-	-	2.16	0.54	0.27
	4	1.66	0.44	0.20	1.95	0.52	0.25	-	-	-	2.19	0.57	0.27
	5	2.03	0.52	0.25	1.97	0.52	0.25	-	-	-	2.00	0.48	0.24
	6	1.95	0.53	0.25	1.98	0.52	0.25	-	-	-	2.13	0.53	0.26
14A	1	1.89	0.56	0.25	2.00	0.63	0.26	1.98	0.60	0.24	1.69	0.50	0.22
	2	2.16	0.68	0.29	2.40	0.64	0.31	1.84	0.54	0.23	2.09	0.63	0.26
	3	1.86	0.60	0.24	2.29	0.69	0.29	1.71	0.54	0.21	2.19	0.67	0.29
	4	1.74	0.56	0.24	1.93	0.62	0.25	1.56	0.49	0.20	1.85	0.48	0.24
	5	2.16	0.69	0.28	1.78	0.54	0.23	1.75	0.55	0.21	2.05	0.57	0.27
	6	2.02	0.54	0.26	1.71	0.54	0.22	1.72	0.54	0.21	1.81	0.56	0.24
16	1	0.04	0.02	0.00	0.06	0.01	0.01	0.02	0.00	0.00	0.04	0.01	0.01
	2	0.04	0.01	0.00	0.04	0.01	0.00	0.05	0.01	0.00	0.05	0.01	0.00
	3	0.04	0.02	0.00	0.04	0.01	0.01	0.03	0.01	0.00	0.03	0.01	0.00
	4	0.09	0.02	0.00	0.05	0.02	0.01	0.02	0.01	0.00	0.05	0.01	0.00
	5	0.04	0.01	0.00	0.04	0.01	0.00	0.05	0.01	0.01	0.28	0.03	0.00
	6	0.08	0.01	0.00	0.08	0.01	0.00	0.03	0.01	0.00	0.07	0.02	0.00
17	1	0.02	0.00	0.00	0.06	0.01	0.00	0.03	0.01	0.00	0.02	0.01	0.00
	2	0.02	0.02	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.04	0.01	0.00
	3	0.03	0.01	0.00	0.23	0.03	0.00	0.01	0.01	0.00	0.05	0.01	0.00
	4	0.04	0.01	0.00	0.03	0.01	0.00	0.08	0.02	0.00	0.04	0.01	0.00
	5	0.03	0.01	0.00	0.09	0.01	0.00	0.00	0.00	0.00	0.06	0.01	0.00
	6	0.33	0.03	0.00	0.02	0.01	0.00	0.02	0.01	0.00	0.43	0.02	0.01
18	1	0.05	0.02	0.00	0.05	0.01	0.00	0.04	0.01	0.00	0.08	0.02	0.00
	2	0.04	0.01	0.00	0.07	0.02	0.00	0.07	0.01	0.00	0.07	0.02	0.00
	3	0.04	0.00	0.00	0.08	0.02	0.00	0.06	0.01	0.00	0.10	0.02	0.01
	4	0.14	0.02	0.00	0.05	0.01	0.00	0.07	0.01	0.00	0.06	0.02	0.00
	5	0.04	0.01	0.00	0.04	0.01	0.00	-	-	-	0.05	0.01	0.00
	6	0.05	0.01	0.00	0.03	0.01	0.00	-	-	-	0.07	0.02	0.00

TABLE D-2. RESULTS OF CHN ANALYSIS FROM GEORGES BANK BENTHIC MONITORING PROGRAM SITE-SPECIFIC STATIONS. SOME SAMPLES NOT COLLECTED ON M7 DUE TO POOR WEATHER CONDITIONS.

		M-5			M-6			M-7			M-8		
Station /	Rep.	%C	%H	%N	%C	%H	%N	%C	%H	%N	%C	%H	%N
SSP 5-1	1	0.06	0.03	0.00	0.17	0.04	0.01	0.05	0.03	0.00	0.05	0.01	0.01
	2	0.07	0.03	0.00	0.12	0.03	0.01	0.03	0.02	0.00	0.06	0.02	0.01
	3	1.12	0.03	0.01	0.06	0.04	0.00	0.04	0.01	0.00	0.04	0.01	0.00
	4	0.06	0.02	0.00	0.04	0.02	0.00	0.04	0.02	0.00	0.07	0.03	0.01
	5	0.16	0.03	0.00	0.04	0.02	0.00	0.05	0.01	0.00	0.20	0.03	0.01
	6	0.14	0.04	0.02	0.02	0.01	0.00	-	-	-	0.14	0.04	0.01
SSP 5-2	1	0.04	0.02	0.00	0.05	0.03	0.00	-	-	-	0.08	0.02	0.01
	2	0.05	0.02	0.00	0.04	0.02	0.00	-	-	-	0.07	0.02	0.00
	3	0.11	0.03	0.00	0.05	0.02	0.00	-	-	-	0.05	0.02	0.00
	4	0.05	0.03	0.00	0.03	0.02	0.00	-	-	-	0.05	0.02	0.00
	5	0.02	0.01	0.00	0.03	0.01	0.00	-	-	-	0.05	0.02	0.01
	6	0.05	0.02	0.00	0.02	0.01	0.00	-	-	-	0.03	0.02	0.00
SSP 5-3	1	0.12	0.04	0.00	0.05	0.02	0.00	-	-	-	0.12	0.02	0.00
	2	0.05	0.02	0.00	0.10	0.03	0.01	-	-	-	0.05	0.02	0.01
	3	0.04	0.02	0.00	0.07	0.03	0.00	-	-	-	0.03	0.01	0.00
	4	0.07	0.02	0.00	0.04	0.02	0.00	-	-	-	0.05	0.02	0.00
	5	0.10	0.03	0.00	0.15	0.03	0.01	-	-	-	0.05	0.02	0.00
	6	0.02	0.01	0.00	0.08	0.02	0.01	-	-	-	0.02	0.01	0.00
SSP 5-4	1	0.05	0.02	0.00	0.08	0.03	0.00	-	-	-	0.04	0.01	0.00
	2	0.04	0.02	0.00	0.03	0.02	0.00	-	-	-	0.04	0.01	0.00
	3	0.03	0.01	0.00	0.03	0.03	0.00	-	-	-	0.03	0.02	0.00
	4	0.04	0.02	0.00	0.05	0.02	0.01	-	-	-	0.13	0.04	0.01
	5	0.03	0.00	0.00	0.04	0.02	0.00	-	-	-	0.04	0.02	0.00
	6	0.02	0.02	0.00	0.02	0.01	0.00	-	-	-	0.03	0.01	0.00
SSP 5-5	1	0.02	0.01	0.00	0.02	0.01	0.00	-	-	-	0.04	0.01	0.00
	2	0.01	0.01	0.00	0.02	0.02	0.00	-	-	-	0.05	0.03	0.00
	3	0.08	0.03	0.00	0.04	0.02	0.00	-	-	-	0.04	0.02	0.00
	4	0.03	0.02	0.00	0.03	0.01	0.00	-	-	-	0.04	0.02	0.00
	5	0.03	0.02	0.00	0.05	0.02	0.00	-	-	-	0.04	0.01	0.00
	6	0.04	0.02	0.00	0.03	0.03	0.00	-	-	-	0.06	0.02	0.01
SSP 5-6	1	0.04	0.02	0.00	0.07	0.02	0.01	-	-	-	0.02	0.01	0.00
	2	0.03	0.02	0.00	0.11	0.04	0.01	-	-	-	0.02	0.01	0.00
	3	0.05	0.02	0.00	0.05	0.02	0.00	-	-	-	0.02	0.01	0.00
	4	0.03	0.01	0.00	0.09	0.03	0.01	-	-	-	0.03	0.02	0.00
	5	0.02	0.01	0.00	0.05	0.02	0.00	-	-	-	0.08	0.03	0.00
	6	0.03	0.02	0.00	0.05	0.02	0.00	-	-	-	0.04	0.02	0.00

TABLE D-2. (Continued)

Station /	Rep.	M-5 %C	M-5 %H	M-5 %N	M-6 %C	M-6 %H	M-6 %N	M-7 %C	M-7 %H	M-7 %N	M-8 %C	M-8 %H	M-8 %N
SSP 5-8	1	0.01	0.01	0.00	0.06	0.02	0.00	-	-	-	0.05	0.02	0.00
	2	0.04	0.02	0.00	0.04	0.01	0.00	-	-	-	0.09	0.05	0.01
	3	0.04	0.02	0.00	0.05	0.02	0.00	-	-	-	0.08	0.02	0.01
	4	0.06	0.03	0.00	0.04	0.03	0.00	-	-	-	0.09	0.03	0.01
	5	0.05	0.03	0.00	0.03	0.01	0.00	-	-	-	0.04	0.01	0.00
	6	0.04	0.02	0.00	0.08	0.03	0.02	-	-	-	0.05	0.01	0.00
SSP 5-9	1	0.04	0.03	0.00	0.10	0.04	0.01	-	-	-	0.11	0.03	0.01
	2	0.10	0.03	0.00	0.07	0.06	0.00	-	-	-	0.08	0.02	0.01
	3	0.03	0.02	0.00	0.06	0.03	0.00	-	-	-	0.13	0.03	0.02
	4	0.05	0.02	0.01	0.08	0.03	0.01	-	-	-	0.10	0.02	0.01
	5	0.04	0.02	0.00	0.24	0.03	0.01	-	-	-	0.10	0.03	0.01
	6	0.06	0.02	0.00	0.09	0.02	0.00	-	-	-	0.16	0.04	0.02
SSP 5-10	1	0.05	0.02	0.00	0.05	0.02	0.00	-	-	-	0.23	0.01	0.00
	2	0.07	0.02	0.00	0.04	0.02	0.00	-	-	-	0.07	0.02	0.01
	3	0.07	0.05	0.00	0.61	0.04	0.01	-	-	-	0.13	0.03	0.01
	4	0.06	0.03	0.00	0.05	0.02	0.01	-	-	-	0.07	0.02	0.01
	5	0.03	0.02	0.00	0.03	0.02	0.00	-	-	-	0.06	0.02	0.01
	6	0.04	0.02	0.00	0.05	0.02	0.00	-	-	-	0.05	0.02	0.00
SSP 5-11	1	0.22	0.03	0.00	0.04	0.02	0.00	-	-	-	0.09	0.03	0.01
	2	0.08	0.02	0.00	0.07	0.02	0.01	-	-	-	0.04	0.01	0.00
	3	0.03	0.01	0.00	0.09	0.03	0.00	-	-	-	0.04	0.02	0.00
	4	0.07	0.02	0.00	0.05	0.02	0.00	-	-	-	0.06	0.02	0.00
	5	0.12	0.03	0.00	0.05	0.03	0.00	-	-	-	0.07	0.03	0.00
	6	0.06	0.02	0.00	0.09	0.03	0.01	-	-	-	0.03	0.02	0.00
SSP 5-12	1	0.04	0.03	0.00	0.04	0.01	0.00	-	-	-	0.07	0.03	0.01
	2	0.06	0.03	0.00	0.07	0.02	0.00	-	-	-	0.03	0.02	0.00
	3	0.03	0.01	0.00	0.04	0.02	0.00	-	-	-	0.02	0.01	0.00
	4	0.05	0.02	0.01	0.11	0.04	0.01	-	-	-	0.03	0.02	0.00
	5	0.01	0.01	0.00	0.03	0.02	0.00	-	-	-	0.02	0.01	0.00
	6	0.05	0.01	0.00	0.03	0.02	0.00	-	-	-	0.03	0.01	0.00
SSP 5-14	1	0.05	0.02	0.00	0.04	0.02	0.00	-	-	-	0.04	0.02	0.00
	2	0.03	0.02	0.00	0.05	0.02	0.00	-	-	-	0.03	0.02	0.00
	3	0.07	0.03	0.00	0.06	0.02	0.00	-	-	-	0.06	0.02	0.00
	4	0.07	0.02	0.00	0.05	0.01	0.00	-	-	-	0.02	0.01	0.00
	5	0.04	0.02	0.00	0.06	0.02	0.00	-	-	-	0.04	0.02	0.00
	6	0.07	0.02	0.00	0.04	0.02	0.00	-	-	-	0.03	0.02	0.00

TABLE D-2. (Continued)

Station / Rep.		M-5 %C	M-5 %H	M-5 %N	M-6 %C	M-6 %H	M-6 %N	M-7 %C	M-7 %H	M-7 %N	M-8 %C	M-8 %H	M-8 %N
SSP 5-16	1	0.02	0.02	0.00	0.02	0.01	0.00	-	-	-	0.07	0.03	0.00
	2	0.07	0.02	0.00	0.06	0.02	0.00	-	-	-	0.04	0.02	0.00
	3	0.06	0.02	0.00	0.03	0.01	0.00	-	-	-	0.03	0.01	0.00
	4	0.04	0.03	0.00	0.03	0.01	0.00	-	-	-	0.03	0.02	0.00
	5	0.06	0.02	0.00	0.04	0.02	0.00	-	-	-	0.06	0.02	0.00
	6	0.04	0.01	0.00	0.04	0.02	0.00	-	-	-	0.06	0.03	0.00
SSP 5-18	1	0.08	0.03	0.01	0.03	0.02	0.00	0.07	0.02	0.00	0.08	0.02	0.00
	2	0.13	0.03	0.03	0.05	0.02	0.00	0.10	0.03	0.01	0.05	0.02	0.00
	3	0.09	0.03	0.01	0.04	0.02	0.00	0.02	0.02	0.00	0.05	0.02	0.00
	4	0.07	0.03	0.00	0.03	0.01	0.00	0.07	0.02	0.00	0.05	0.02	0.00
	5	0.06	0.02	0.01	0.03	0.02	0.00	0.07	0.02	0.00	0.08	0.02	0.01
	6	0.11	0.03	0.00	0.05	0.02	0.00	0.06	0.02	0.00	0.06	0.02	0.00
SSP 5-20	1	0.01	0.01	0.00	0.03	0.02	0.00	-	-	-	0.03	0.01	0.00
	2	0.01	0.02	0.00	0.03	0.02	0.00	-	-	-	0.02	0.01	0.00
	3	0.05	0.02	0.00	0.02	0.01	0.00	-	-	-	0.02	0.01	0.00
	4	0.03	0.02	0.00	0.04	0.03	0.00	-	-	-	0.08	0.02	0.00
	5	0.03	0.01	0.00	0.03	0.02	0.00	-	-	-	0.05	0.02	0.00
	6	0.03	0.02	0.00	0.03	0.01	0.00	-	-	-	0.01	0.01	0.00
SSP 5-22	1	0.02	0.01	0.00	0.08	0.04	0.01	-	-	-	0.03	0.01	0.00
	2	0.10	0.02	0.01	0.07	0.03	0.00	-	-	-	0.02	0.01	0.00
	3	0.06	0.02	0.00	0.06	0.02	0.00	-	-	-	0.05	0.02	0.00
	4	0.05	0.02	0.00	0.04	0.01	0.00	-	-	-	0.05	0.02	0.00
	5	0.03	0.02	0.00	0.09	0.03	0.01	-	-	-	0.02	0.01	0.00
	6	0.08	0.02	0.00	0.06	0.02	0.00	-	-	-	0.07	0.04	0.01
SSP 5-25	1	0.02	0.00	0.00	0.09	0.03	0.01	-	-	-	0.06	0.03	0.00
	2	0.03	0.01	0.00	0.10	0.03	0.00	-	-	-	0.05	0.02	0.00
	3	0.04	0.02	0.00	0.08	0.03	0.00	-	-	-	0.09	0.03	0.01
	4	0.05	0.02	0.00	0.08	0.02	0.00	-	-	-	0.06	0.02	0.00
	5	2.03	0.06	0.00	0.05	0.02	0.00	-	-	-	0.08	0.02	0.01
	6	0.04	0.02	0.00	0.06	0.02	0.00	-	-	-	0.06	0.02	0.01
SSP 5-28	1	0.06	0.01	0.00	0.04	0.03	0.00	0.03	0.01	0.00	0.03	0.01	0.00
	2	0.04	0.01	0.00	0.03	0.01	0.00	0.03	0.01	0.00	0.01	0.01	0.00
	3	0.04	0.01	0.00	0.07	0.02	0.00	0.03	0.01	0.00	0.02	0.01	0.00
	4	0.03	0.01	0.00	0.03	0.01	0.00	0.01	0.00	0.00	0.03	0.01	0.00
	5	0.06	0.02	0.00	0.06	0.02	0.00	0.01	0.01	0.00	0.03	0.01	0.00
	6	0.02	0.01	0.00	0.03	0.01	0.00	0.03	0.02	0.00	0.03	0.02	0.00

TABLE D-2. (Continued)

		M-5			M-6			M-7			M-8		
Station	/ Rep.	%C	%H	%N	%C	%H	%N	%C	%H	%N	%C	%H	%N
SSP 5-29	1	0.18	0.05	0.02	0.12	0.04	0.00	-	-	-	0.36	0.08	0.02
	2	3.19	0.19	0.03	0.58	0.11	0.01	-	-	-	0.16	0.06	0.01
	3	2.52	0.21	0.02	0.29	0.08	0.00	-	-	-	0.11	0.03	0.02
	4	0.55	0.09	0.01	0.19	0.07	0.01	-	-	-	0.26	0.06	0.01
	5	0.09	0.03	0.00	0.18	0.05	0.01	-	-	-	1.09	0.15	0.01
	6	0.17	0.04	0.01	0.13	0.04	0.01	-	-	-	0.16	0.05	0.02

APPENDIX E

TABLE E-1. COMMUNITY PARAMETERS FOR REGIONAL STATIONS CALCULATED FOR EACH CRUISE. ALL REPLICATES COMBINED.

Sta.	Cruise	Total Individuals	Total Species	Spp./50	Spp./100	Spp./1000	H'	E
1	M-1	1875	75	16.2	22.5	59.3	3.96	0.636
	M-2	1172	49	16.1	21.7	47.1	3.87	0.690
	M-3	1824	49	11.2	14.4	37.5	3.24	0.576
	M-4	1020	50	15.4	20.2	49.7	3.81	0.675
	M-5	1121	52	15.7	20.9	50.3	3.91	0.685
	M-6	2011	45	12.0	15.5	36.1	3.32	0.605
	M-7	1550	53	14.4	18.8	45.0	3.75	0.654
	M-8	1460	54	12.6	17.7	46.4	3.05	0.530
2	M-1	2155	92	21.4	30.0	72.8	4.65	0.712
	M-2	2155	88	20.2	28.8	68.4	4.36	0.676
	M-3	2767	85	18.1	25.8	60.7	4.00	0.624
	M-4	2854	77	16.8	23.2	56.1	3.87	0.617
	M-5	3819	95	20.8	29.2	65.8	4.49	0.683
	M-6	4326	91	19.1	27.5	64.3	4.21	0.647
	M-7	4550	88	17.8	25.2	56.8	4.02	0.622
	M-8	4131	87	18.9	26.7	57.8	4.19	0.650
3	M-1	2134	142	27.5	41.1	113.1	5.53	0.773
	M-2	1216	107	25.7	39.3	101.4	5.17	0.667
	M-3	2167	118	26.5	39.1	96.4	5.32	0.773
	M-4	2259	128	25.9	38.0	100.8	5.32	0.760
	M-5	3181	148	26.2	39.1	106.2	5.34	0.741
	M-6	2885	115	21.6	32.5	89.1	4.59	0.670
	M-7	2460	120	23.0	34.5	93.0	4.76	0.689
	M-8	2513	124	26.4	38.6	96.5	5.35	0.609
4	M-1	2901	43	8.5	11.0	29.3	2.61	0.480
	M-2	2914	41	9.6	12.4	27.9	2.72	0.507
	M-3	2985	44	8.0	10.4	27.2	2.42	0.444
	M-4	2359	32	7.3	8.8	22.3	2.20	0.441
	M-5	3916	52	8.9	11.9	32.0	2.46	0.431
	M-6	7036	41	5.1	6.7	16.4	1.11	0.207
	M-7			NO SAMPLE '				
	M-8	3496	45	7.8	10.3	27.9	2.00	0.609
5	M-1	5299	91	18.6	25.7	58.5	4.33	0.665
	M-2	4138	82	20.4	27.8	58.0	4.56	0.718
	M-3	4806	83	19.4	26.9	57.7	4.40	0.773
	M-4	7925	90	19.4	26.7	55.1	4.40	0.677
	M-5	9151	115	19.9	28.0	65.7	4.51	0.659
	M-6	5825	94	18.6	26.7	60.6	4.27	0.652
	M-7	7738	97	17.6	25.2	58.3	4.07	0.617
	M-8	7308	112	19.2	27.0	64.2	4.45	0.653

TABLE E-1. (Continued)

Sta.	Cruise	Total Individuals	Total Species	Spp./50	Spp./100	Spp./1000	H'	E
6	M-1	3916	134	20.0	30.8	87.2	4.10	0.581
	M-2	4353	129	19.2	28.8	78.9	4.27	0.609
	M-3	4407	115	16.8	25.5	75.4	3.91	0.572
	M-4	4028	115	20.6	30.4	77.1	4.53	0.662
	M-5	2875	138	24.0	36.2	94.4	4.99	0.702
	M-6	4917	125	18.5	28.3	80.3	4.12	0.591
	M-7	3289	112	20.6	30.4	79.6	4.49	0.660
	M-8	2484	115	23.1	34.4	87.8	4.81	0.702
7	M-1	1421	132	30.0	44.5	118.3	5.75	0.816
	M-2	2492	124	26.1	37.7	91.0	5.30	0.762
	M-3	2304	119	25.6	36.1	89.8	5.26	0.762
	M-4	2469	136	26.7	39.0	99.3	5.38	0.759
7A	M-5	2495	91	19.9	28.5	68.0	4.47	0.687
	M-6	3139	113	21.5	30.3	76.3	4.73	0.694
	M-7	2942	101	20.6	29.3	74.0	4.61	0.692
	M-8	1816	87	21.0	29.3	71.7	4.59	0.712
8	M-1	1827	98	19.4	29.4	80.2	3.96	0.599
	M-2	1951	103	20.3	29.8	81.1	4.27	0.638
	M-3	2462	106	18.1	26.3	74.9	3.91	0.582
	M-4	1389	89	19.1	28.0	76.7	3.97	0.613
	M-5	2392	114	20.9	30.2	83.3	4.49	0.658
	M-6	1576	89	20.2	29.3	76.7	4.30	0.664
	M-7	2056	111	20.7	31.2	87.2	4.25	0.625
	M-8	1993	107	19.6	29.2	83.1	4.11	0.609
9	M-1	2952	133	19.8	31.1	88.8	3.92	0.555
	M-2	2443	103	19.4	29.1	79.7	4.10	0.614
	M-3	2842	109	19.1	28.7	77.9	3.98	0.587
	M-4	3136	112	18.2	28.1	78.4	3.75	0.551
	M-5	2836	111	21.2	32.3	80.6	4.23	0.622
	M-6	2398	100	21.9	32.5	79.3	4.54	0.683
	M-7			NO SAMPLE				
	M-8	2185	117	22.8	34.4	90.8	4.64	0.675
10	M-1	1274	52	14.2	19.7	48.2	3.57	0.627
	M-2	4869	51	7.2	10.1	28.3	1.59	0.280
	M-3	1738	64	12.9	18.2	52.2	3.33	0.556
	M-4	903	47	13.9	19.3	*	3.49	0.629
	M-5	1732	67	17.5	24.6	56.6	3.96	0.653
	M-6	14066	58	4.2	6.5	21.5	7.16	0.122
	M-7	6136	54	6.2	9.5	29.2	1.14	0.198
	M-8	6836	68	5.7	8.6	29.5	1.12	0.184

TABLE E-1. (Continued)

Sta.	Cruise	Total Individuals	Total Species	Spp./50	Spp./100	Spp./1000	H'	E
11	M-1	1450	87	20.5	28.1	75.3	4.57	0.710
	M-2	1133	54	15.0	20.6	51.5	3.45	0.599
	M-3	969	66	18.1	25.0	*	4.25	0.703
	M-4	2147	59	15.5	20.1	46.3	3.90	0.663
	M-5	2664	80	18.6	25.2	57.7	4.26	0.673
	M-6	1644	59	13.0	19.0	49.6	2.74	0.465
	M-7			NO SAMPLE '				
	M-8	1031	77	19.8	27.7	76.1	4.51	0.719
12	M-1	5749	143	15.3	23.8	77.5	3.20	0.496
	M-2	4369	123	14.4	22.1	70.6	3.06	0.441
	M-3	4876	124	16.4	25.4	76.3	3.41	0.490
	M-4	4945	125	17.8	26.9	77.1	3.73	0.536
	M-5	5278	145	20.3	31.0	90.6	4.21	0.586
	M-6	4801	143	18.8	28.8	83.0	3.97	0.465
	M-7			NO SAMPLE '				
	M-8	6074	130	12.9	20.8	68.9	2.53	0.361
13	M-1	6451	108	13.5	18.7	53.6	3.57	0.528
	M-2	8840	92	12.9	17.6	48.3	3.48	0.534
	M-3	10089	99	14.6	19.6	51.6	3.77	0.569
	M-4	3274	79	14.9	21.2	55.8	3.72	0.590
	M-5	11982	98	14.3	18.9	48.5	3.69	0.558
	M-6	10284	101	13.9	18.8	49.3	3.65	0.548
	M-7	9617	88	13.5	17.8	44.4	3.58	0.555
	M-8	8897	104	14.3	19.8	53.9	3.68	0.550
13A	M-1			NO SAMPLES "				
	M-2							
	M-3							
	M-4							
	M-5	5091	89	15.8	21.9	52.0	3.86	0.596
	M-6	7308	87	14.4	20.0	48.6	3.51	0.549
	M-7			NO SAMPLE '				
	M-8	5370	94	16.4	23.3	57.9	3.84	0.586
14A	M-1			NO SAMPLES "				
	M-2							
	M-3							
	M-4							
	M-5	1994	110	23.6	34.8	88.8	4.87	0.718
	M-6	1809	98	21.2	31.3	80.4	4.48	0.677
	M-7	1154	91	22.5	33.6	86.9	4.57	0.703
	M-8	1620	96	19.9	29.8	82.5	4.32	0.656

TABLE E-1. (Continued)

Sta.	Cruise	Total Individuals	Total Species	Spp./50	Spp./100	Spp./1000	H'	E
15	M-1	2854	63	12.4	17.6	40.8	2.69	0.450
	M-2	1254	69	16.8	24.9	63.9	3.78	0.619
	M-3	469	38	15.0	21.4	*	3.54	0.675
	M-4	948	51	13.4	19.1	*	3.23	0.570
	M-5	NO SAMPLES '''						
	M-6							
	M-7							
	M-8							
16	M-1	951	114	27.7	41.6	*	5.42	0.793
	M-2	852	97	25.5	37.4	*	5.19	0.786
	M-3	1451	96	23.4	33.4	83.2	4.88	0.742
	M-4	1261	97	25.3	36.1	89.6	5.14	0.779
	M-5	2185	127	26.6	38.5	99.5	5.37	0.768
	M-6	2051	124	24.9	37.1	98.3	5.14	0.739
	M-7	1823	123	26.3	38.0	99.1	5.33	0.768
	M-8	2063	112	24.5	35.0	88.3	5.08	0.746
17	M-1	482	77	25.8	37.9	*	5.17	0.824
	M-2	681	84	25.4	37.6	*	5.08	0.795
	M-3	1055	102	25.8	37.6	100.0	5.23	0.783
	M-4	777	100	26.8	40.4	*	5.31	0.799
	M-5	1705	133	27.7	41.4	110.6	5.49	0.778
	M-6	1404	107	26.6	39.8	96.5	5.26	0.780
	M-7	1324	96	24.6	34.2	86.9	5.09	0.774
	M-8	1957	118	26.8	39.7	97.1	5.32	0.773
18	M-1	1790	124	23.4	35.8	99.6	4.63	0.665
	M-2	1138	92	23.5	34.5	87.5	4.66	0.714
	M-3	2757	113	19.7	29.7	78.9	3.94	0.578
	M-4	1185	89	20.8	31.5	83.7	4.13	0.638
	M-5	2674	117	21.2	31.5	83.2	4.32	0.629
	M-6	1927	101	21.9	32.4	83.4	4.49	0.673
	M-7	2054	87	18.2	27.1	69.0	3.71	0.576
	M-8	2091	103	21.2	31.4	81.2	4.33	0.647

*Sample size is not large enough for calculations of these parameters.
NO SAMPLE ' - Cruise 7 was shortened due to poor weather conditions.
NO SAMPLES '' - These stations added after Cruise 4.
NO SAMPLES ''' - This station dropped after Cruise 4.

TABLE E-2. COMMUNITY PARAMETERS FOR SITE-SPECIFIC STATIONS CALCULATED FOR EACH CRUISE. ALL REPLICATES COMBINED.

Sta.	Cruise	Total Individuals	Total Species	Spp./100	Spp./1000	H'	E
5-1	M-1	5299	91	25.6	58.5	4.33	.655
	M-2	4137	82	27.8	58.0	4.56	.718
	M-3	4806	83	26.9	57.7	4.40	.690
	M-4	7925	89	26.6	54.5	4.39	.679
	M-5	9151	115	28.0	65.7	4.51	.659
	M-6	5825	94	26.7	60.6	4.27	.652
	M-7	7737	97	25.2	58.3	4.07	.617
	M-8	7308	112	27.0	64.2	4.45	.653
5-2	M-1	5467	89	25.7	56.9	4.39	.678
	M-2	3318	80	27.9	58.1	4.62	.730
	M-3	4775	84	26.6	55.1	4.43	.693
	M-4	6655	96	27.1	56.4	4.43	.673
	M-5	8030	104	26.8	61.3	4.42	.660
	M-6	8091	94	25.2	58.0	4.14	.632
	M-7		NO SAMPLE				
	M-8	6910	100	27.3	62.0	4.44	.668
5-3	M-1	4520	90	24.8	57.1	4.26	.657
	M-2	4345	83	25.5	54.0	4.40	.690
	M-3	4387	86	25.7	56.6	4.37	.680
	M-4	3767	77	27.6	55.7	4.52	.722
	M-5	7745	101	26.0	60.6	4.31	.647
	M-6	6425	102	29.4	63.4	4.60	.689
	M-7		NO SAMPLE				
	M-8	5317	102	28.5	65.2	4.56	.683
5-4	M-1	5011	85	25.1	55.4	4.32	.673
	M-2	3710	82	26.9	57.2	4.47	.703
	M-3	4487	91	26.3	59.3	4.37	.672
	M-4	4716	91	27.2	57.6	4.43	.681
	M-5	7588	107	28.0	62.3	4.55	.676
	M-6	6024	103	30.0	70.1	4.65	.695
	M-7		NO SAMPLE				
	M-8	5947	97	27.0	59.9	4.43	.671
5-5	M-1	5710	82	22.7	52.8	4.02	.632
	M-2	3490	93	27.1	63.3	4.40	.673
	M-3	3128	88	26.2	62.5	4.32	.668
	M-4	4156	79	28.2	53.7	4.56	.723
	M-5	5259	94	28.2	62.3	4.51	.688
	M-6	4090	100	28.0	68.0	4.43	.667
	M-7		NO SAMPLE				
	M-8	4702	105	29.5	67.6	4.63	.689

TABLE E-2. (Continued)

Sta.	Cruise	Total Individuals	Total Species	Spp./100	Spp./1000	H'	E
5-6	M-1	5941	96	25.6	57.6	4.29	.651
	M-2	3404	73	25.9	51.2	4.39	.710
	M-3	4556	80	25.5	53.6	4.30	.680
	M-4	5550	91	26.6	56.0	4.43	.680
	M-5	8548	100	26.0	57.3	4.35	.655
	M-6	5950	99	28.0	63.5	4.52	.687
	M-7		NO SAMPLE				
	M-8	4145	91	28.0	63.9	4.54	.698
5-8	M-1	6030	94	24.7	54.7	4.31	.658
	M-2	4561	79	25.6	53.0	4.39	.700
	M-3	5381	95	26.5	56.9	4.42	.672
	M-4	9105	94	26.7	56.6	4.41	.673
	M-5	10272	112	26.0	62.2	4.39	.645
	M-6	7525	109	25.6	61.2	4.07	.601
	M-7		NO SAMPLE				
	M-8	8671	114	26.4	61.2	4.37	.639
5-9	M-1	8069	92	23.4	54.1	4.13	.633
	M-2	5372	79	25.1	53.0	4.37	.693
	M-3	5207	84	26.6	54.5	4.42	.692
	M-4	7318	98	26.0	55.0	4.38	.662
	M-5	8672	107	27.7	63.4	4.54	.673
	M-6	8126	104	28.1	64.6	4.56	.681
	M-7		NO SAMPLE				
	M-8	6879	110	26.5	65.0	4.40	.649
5-10	M-1	6091	91	25.3	55.2	4.35	.668
	M-2	6714	87	25.9	55.7	4.32	.671
	M-3	3110	74	27.5	55.9	4.48	.722
	M-4	7608	95	27.5	57.3	4.49	.683
	M-5	9774	111	27.5	61.9	4.52	.665
	M-6	9135	125	27.1	66.5	4.36	.627
	M-7		NO SAMPLE				
	M-8	6654	101	26.2	60.8	4.38	.658
5-11	M-1	5155	87	24.8	57.1	4.30	.667
	M-2	3838	81	26.8	55.6	4.47	.705
	M-3	2174	86	26.4	68.0	4.32	.672
	M-4	5921	87	26.6	56.4	4.36	.677
	M-5	7600	103	26.7	62.9	4.39	.657
	M-6	5934	105	29.3	70.0	4.53	.674
	M-7		NO SAMPLE				
	M-8	4531	96	28.3	63.8	4.49	.682

TABLE E-2. (Continued)

Sta.	Cruise	Total Individuals	Total Species	Spp./100	Spp./1000	H'	E
5-12	M-1	5015	105	23.6	63.3	4.10	.611
	M-2	2780	75	26.3	55.0	4.45	.715
	M-3	2237	87	27.3	67.3	4.38	.680
	M-4	3412	95	30.1	67.3	4.69	.714
	M-5	6543	118	29.0	71.2	4.59	.666
	M-6	3498	116	27.2	76.0	4.26	.621
	M-7		NO SAMPLE				
	M-8	2806	97	29.9	74.5	4.65	.704
5-14	M-1	6220	91	25.5	56.7	4.31	.662
	M-2	4123	73	26.4	52.1	4.41	.712
	M-3	3493	82	26.0	57.2	4.40	.692
	M-4	5000	81	25.3	53.4	4.28	.675
	M-5	9430	102	26.5	57.5	4.43	.664
	M-6	7206	98	26.5	58.4	4.39	.664
	M-7		NO SAMPLE				
	M-8	6005	90	26.4	55.5	4.44	.683
5-16	M-1	8982	91	23.0	51.7	4.13	.635
	M-2	4161	88	27.9	59.9	4.57	.708
	M-3	5370	91	24.4	54.4	4.24	.651
	M-4	7623	89	26.2	55.4	4.36	.674
	M-5	10911	108	27.6	60.9	4.53	.670
	M-6	5728	102	26.4	62.5	4.36	.653
	M-7		NO SAMPLE				
	M-8	9422	106	23.2	56.8	4.11	.610
5-18	M-1	7680	99	25.3	56.3	4.32	.651
	M-2	5018	90	26.7	58.7	4.43	.683
	M-3	4454	94	27.6	60.6	4.44	.678
	M-4	5894	88	26.4	56.1	4.37	.677
	M-5	6497	112	28.8	67.4	4.58	.673
	M-6	6546	117	29.8	69.3	4.65	.677
	M-7	6382	100	26.6	61.0	4.32	.650
	M-8	7874	115	25.1	63.1	4.23	.618
5-20	M-1	5311	87	26.3	55.6	4.45	.691
	M-2	3026	75	26.0	55.3	4.49	.720
	M-3	1407	75	26.9	68.3	4.34	.700
	M-4	3011	87	28.4	64.9	4.59	.713
	M-5	4760	103	30.4	69.2	4.72	.705
	M-6	2120	90	27.1	71.2	4.32	.665
	M-7		NO SAMPLE				
	M-8	2955	107	29.0	75.7	4.64	.688

TABLE E-2. (Continued)

Sta.	Cruise	Total Individuals	Total Species	Spp./100	Spp./1000	H'	E
5-22	M-1	6322	91	24.6	55.8	4.21	.647
	M-2	4327	75	24.1	52.7	4.25	.682
	M-3	2988	82	28.2	59.3	4.60	.724
	M-4	5673	82	24.6	52.4	4.21	.662
	M-5	9857	102	28.0	61.4	4.55	.683
	M-6	7195	108	27.6	61.8	4.56	.675
	M-7		NO SAMPLE				
	M-8	7333	100	27.5	59.5	4.55	.684
5-25	M-1	4270	116	26.0	71.5	4.33	.632
	M-2	3348	92	23.2	62.7	3.92	.600
	M-3	1621	97	27.1	80.0	4.27	.647
	M-4	4032	94	27.6	63.4	4.52	.690
	M-5	6596	126	28.9	70.7	4.54	.651
	M-6	3561	105	27.8	75.1	4.25	.634
	M-7		NO SAMPLE				
	M-8	4869	115	24.7	67.5	4.18	.611
5-28	M-1	4411	73	24.4	50.8	4.26	.688
	M-2	4683	77	23.2	50.7	4.05	.645
	M-3	5638	79	22.9	53.4	3.61	.572
	M-4	6169	79	24.2	53.5	4.21	.667
	M-5	6998	101	26.9	62.1	4.49	.674
	M-6	10083	97	21.2	52.6	3.48	.527
	M-7	4295	80	24.3	51.6	4.30	.680
	M-8	4238	75	25.4	54.1	4.35	.699
5-29	M-1	2615	143	40.4	106.2	5.41	.755
	M-2	3166	116	28.8	80.5	4.15	.605
	M-3	2924	116	30.5	83.9	4.31	.629
	M-4	4020	129	32.1	81.0	4.84	.690
	M-5	3425	133	35.8	93.0	5.04	.714
	M-6	3721	114	27.6	75.8	3.98	.582
	M-7		NO SAMPLE				
	M-8	2860	112	31.4	81.4	4.57	.672

NO SAMPLE due to poor weather conditions.

APPENDIX F

TABLE F-1. SEDIMENT GRAIN SIZE ANALYSIS OF REGIONAL STATIONS, SHOWING AVERAGE PERCENT COMPOSITION AND ONE STANDARD DEVIATION FOR EACH SIZE CLASS MEASURED.

	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay
Sta 1								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.26 ± 0.12	0.00 ± 0.00	7.14 ± 5.92	37.72 ± 6.80	53.02 ± 12.10	1.66 ± 0.81	0.01 ± 0.01	0.03 ± 0.02
M-3	0.40 ± 0.42	0.00 ± 0.00	1.32 ± 1.03	47.14 ± 10.24	51.08 ± 10.52	0.00 ± 0.00	0.03 ± 0.02	0.03 ± 0.02
M-4	0.46 ± 0.24	0.00 ± 0.00	1.66 ± 1.50	29.84 ± 5.76	66.32 ± 4.52	1.66 ± 2.65	0.03 ± 0.04	0.03 ± 0.02
M-5	0.30 ± 0.15	0.00 ± 0.00	0.83 ± 1.32	35.55 ± 7.51	65.11 ± 7.58	0.17 ± 0.41	0.02 ± 0.02	0.03 ± 0.03
M-6	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-7	0.41 ± 0.34	0.00 ± 0.00	0.79 ± 0.72	37.44 ± 5.05	59.38 ± 5.46	1.91 ± 0.50	0.06 ± 0.07	0.08 ± 0.07
M-8	0.50 ± 0.49	0.00 ± 0.00	0.41 ± 0.80	35.33 ± 7.56	61.21 ± 6.56	2.50 ± 0.80	0.02 ± 0.02	0.02 ± 0.01
Sta 2								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	2.76 ± 2.56	4.48 ± 3.05	24.50 ± 8.12	60.13 ± 11.68	8.11 ± 2.33	0.00 ± 0.00	0.01 ± 0.00	0.01 ± 0.01
M-3	1.78 ± 1.70	3.23 ± 4.00	31.20 ± 9.77	50.66 ± 9.53	13.10 ± 2.78	0.00 ± 0.00	0.01 ± 0.00	0.01 ± 0.01
M-4	1.21 ± 1.03	0.00 ± 0.00	17.80 ± 7.61	64.18 ± 5.84	16.44 ± 2.90	0.00 ± 0.00	0.02 ± 0.01	0.02 ± 0.00
M-5	1.81 ± 2.67	2.08 ± 2.08	21.08 ± 11.12	64.79 ± 11.68	10.18 ± 3.98	0.00 ± 0.00	0.03 ± 0.01	0.01 ± 0.01
M-6	3.10 ± 2.48	1.55 ± 2.12	21.34 ± 13.97	56.84 ± 14.03	15.71 ± 3.95	1.33 ± 0.92	0.08 ± 0.06	0.06 ± 0.06
M-7	2.57 ± 1.92	5.06 ± 5.18	31.50 ± 6.04	50.02 ± 10.16	7.87 ± 4.32	1.21 ± 0.41	0.04 ± 0.03	0.06 ± 0.03
M-8	1.99 ± 2.00	1.91 ± 2.10	31.24 ± 9.51	51.38 ± 9.96	12.26 ± 3.90	1.41 ± 0.53	0.03 ± 0.03	0.07 ± 0.05
Sta 3								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	1.45 ± 1.14	0.00 ± 0.00	3.10 ± 2.79	41.06 ± 13.70	53.14 ± 16.61	0.98 ± 1.08	0.51 ± 0.88	0.10 ± 0.05
M-3	2.63 ± 2.59	0.00 ± 0.00	1.62 ± 0.80	38.97 ± 4.20	54.53 ± 4.43	1.61 ± 2.59	0.34 ± 0.15	0.21 ± 0.03
M-4	6.84 ± 6.34	0.00 ± 0.00	0.65 ± 1.60	36.17 ± 4.91	49.93 ± 4.88	5.84 ± 3.30	0.35 ± 0.18	0.23 ± 0.11
M-5	4.23 ± 1.64	0.00 ± 0.00	5.34 ± 2.45	48.73 ± 4.27	40.08 ± 5.24	0.16 ± 0.40	0.92 ± 0.24	0.54 ± 0.16
M-6	4.75 ± 1.86	0.00 ± 0.00	0.60 ± 0.78	34.63 ± 7.04	54.58 ± 7.41	3.56 ± 2.49	1.11 ± 0.22	0.77 ± 0.17
M-7	3.51 ± 2.03	0.09 ± 0.21	3.22 ± 1.14	40.45 ± 5.31	48.33 ± 4.34	2.14 ± 0.65	1.35 ± 0.26	0.91 ± 0.12
M-8	5.29 ± 5.41	0.00 ± 0.00	2.54 ± 0.57	40.26 ± 4.11	46.65 ± 6.05	3.21 ± 0.86	1.29 ± 0.51	0.77 ± 0.14
Sta 4								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.07 ± 0.07	0.00 ± 0.00	0.00 ± 0.00	2.83 ± 2.48	91.60 ± 3.72	5.50 ± 2.53	0.01 ± 0.01	0.01 ± 0.01
M-3	0.21 ± 0.27	0.00 ± 0.00	0.00 ± 0.00	11.30 ± 3.26	73.76 ± 8.29	14.63 ± 8.64	0.31 ± 0.63	0.10 ± 0.15
M-4	0.16 ± 0.12	0.00 ± 0.00	0.33 ± 0.81	5.98 ± 3.78	75.51 ± 8.58	17.96 ± 6.42	0.03 ± 0.03	0.02 ± 0.01
M-5	0.09 ± 0.10	0.00 ± 0.00	0.25 ± 0.50	7.74 ± 6.74	85.82 ± 6.98	5.99 ± 0.80	0.07 ± 0.02	0.03 ± 0.02
M-6	0.04 ± 0.03	0.00 ± 0.00	0.00 ± 0.00	0.28 ± 0.41	81.54 ± 1.95	17.72 ± 2.17	0.06 ± 0.06	0.26 ± 0.03
M-7	0.37 ± 0.51	0.00 ± 0.00	0.00 ± 0.00	6.72 ± 1.84	82.16 ± 2.83	9.98 ± 1.43	0.32 ± 0.28	0.46 ± 0.26
M-8	0.16 ± 0.18	0.00 ± 0.00	0.00 ± 0.00	6.62 ± 2.46	82.01 ± 3.02	10.71 ± 0.86	0.16 ± 0.08	0.34 ± 0.04

TABLE F-1. (Continued)

	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay
Sta 6								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.23 ± 0.22	0.33 ± 0.80	3.25 ± 2.76	32.12 ± 5.50	49.97 ± 4.46	11.33 ± 2.88	1.00 ± 0.35	0.50 ± 0.16
M-3	0.80 ± 0.44	0.00 ± 0.00	2.30 ± 2.22	39.03 ± 2.96	42.16 ± 5.92	15.30 ± 4.72	0.93 ± 0.34	0.28 ± 0.10
M-4	0.73 ± 0.63	0.00 ± 0.00	3.26 ± 2.74	35.50 ± 4.11	47.13 ± 5.38	12.27 ± 1.13	0.82 ± 0.24	0.30 ± 0.08
M-5	0.97 ± 1.18	0.00 ± 0.00	2.23 ± 2.75	33.45 ± 5.56	41.83 ± 4.18	19.06 ± 7.19	2.07 ± 0.70	0.89 ± 0.23
M-6	0.79 ± 0.88	0.00 ± 0.00	0.00 ± 0.00	21.83 ± 3.14	54.58 ± 2.26	18.62 ± 2.49	2.71 ± 0.33	1.47 ± 0.13
M-7	0.96 ± 1.18	0.20 ± 0.22	6.09 ± 3.26	35.49 ± 2.71	40.23 ± 4.90	13.26 ± 1.08	2.61 ± 0.51	1.14 ± 0.25
M-8	0.91 ± 1.42	0.00 ± 0.00	2.95 ± 2.20	35.48 ± 3.54	42.68 ± 2.62	14.54 ± 1.39	2.34 ± 0.69	1.10 ± 0.30
Sta 7								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	9.84 ± 3.11	8.32 ± 4.26	30.78 ± 15.66	27.98 ± 4.92	14.99 ± 8.52	6.98 ± 7.20	0.94 ± 0.47	0.21 ± 0.06
M-3	8.69 ± 8.96	9.70 ± 7.94	32.54 ± 11.58	24.49 ± 8.86	19.84 ± 11.59	3.27 ± 5.07	1.21 ± 0.28	0.29 ± 0.06
M-4	8.16 ± 9.24	1.30 ± 2.08	29.30 ± 5.38	37.73 ± 9.63	16.23 ± 4.87	5.72 ± 3.38	1.28 ± 0.29	0.28 ± 0.08
M-5	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-6	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Sta 7A								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-3	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-4	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-5	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	1.76 ± 1.78	12.94 ± 1.42	62.40 ± 6.10	19.18 ± 3.90	3.74 ± 0.55
M-6	0.03 ± 0.04	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	10.68 ± 10.17	61.78 ± 9.72	23.37 ± 1.16	4.14 ± 0.49
M-7	0.04 ± 0.07	0.00 ± 0.00	0.00 ± 0.00	0.30 ± 0.55	9.94 ± 5.82	58.92 ± 7.82	26.87 ± 11.66	3.93 ± 0.74
M-8	0.01 ± 0.02	0.00 ± 0.00	0.00 ± 0.00	0.08 ± 0.20	11.05 ± 3.71	62.91 ± 2.93	22.08 ± 4.88	3.87 ± 0.22
Sta 8								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.12 ± 0.14	0.33 ± 0.81	27.46 ± 3.86	43.52 ± 6.15	22.17 ± 2.02	5.79 ± 2.76	0.40 ± 0.06	0.14 ± 0.04
M-3	0.07 ± 0.06	0.33 ± 0.81	24.83 ± 11.75	48.96 ± 3.64	21.33 ± 5.69	3.80 ± 4.45	0.52 ± 0.24	0.18 ± 0.04
M-4	0.10 ± 0.11	0.33 ± 0.81	28.63 ± 11.62	41.05 ± 4.06	21.35 ± 6.40	7.94 ± 3.08	0.45 ± 0.10	0.14 ± 0.03
M-5	0.08 ± 0.11	0.00 ± 0.00	21.00 ± 4.10	53.18 ± 4.57	21.82 ± 4.60	2.46 ± 0.81	1.10 ± 0.49	0.36 ± 0.16
M-6	0.15 ± 0.18	0.00 ± 0.00	13.65 ± 4.38	50.02 ± 1.42	26.77 ± 3.60	7.40 ± 2.25	1.41 ± 0.33	0.62 ± 0.10
M-7	0.09 ± 0.10	0.72 ± 0.66	23.52 ± 5.35	46.13 ± 3.03	21.30 ± 4.20	6.16 ± 1.44	1.58 ± 0.42	0.51 ± 0.10
M-8	0.04 ± 0.02	0.31 ± 0.56	20.80 ± 8.98	44.80 ± 3.60	24.30 ± 5.69	7.62 ± 2.74	1.42 ± 0.44	0.72 ± 0.24

TABLE F-1. (Continued)

	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay
Sta 9								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.13 ± 0.10	0.00 ± 0.00	3.14 ± 3.78	40.24 ± 3.42	43.04 ± 5.70	12.53 ± 4.78	0.71 ± 0.09	0.23 ± 0.05
M-3	0.20 ± 0.23	0.00 ± 0.00	1.80 ± 1.78	41.19 ± 8.14	43.30 ± 8.70	12.13 ± 11.02	1.13 ± 0.58	0.23 ± 0.09
M-4	0.17 ± 0.19	0.00 ± 0.00	7.40 ± 5.58	34.71 ± 6.85	38.97 ± 4.25	17.60 ± 5.08	0.91 ± 0.29	0.24 ± 0.04
M-5	0.00 ± 0.01	0.00 ± 0.00	1.14 ± 0.96	27.81 ± 6.66	50.36 ± 3.52	18.78 ± 5.39	1.50 ± 0.56	0.40 ± 0.08
M-6	0.10 ± 0.17	0.00 ± 0.00	0.20 ± 0.31	33.00 ± 7.47	44.22 ± 4.64	19.21 ± 3.88	2.25 ± 0.56	1.04 ± 0.16
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	0.14 ± 0.25	0.00 ± 0.00	1.06 ± 1.08	34.30 ± 7.84	40.96 ± 5.82	20.54 ± 2.91	2.24 ± 0.37	0.78 ± 0.18
Sta 10								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	1.57 ± 1.35	0.00 ± 0.00	2.62 ± 1.95	45.92 ± 6.94	48.50 ± 7.05	1.31 ± 1.60	0.04 ± 0.04	0.01 ± 0.01
M-3	1.48 ± 1.36	0.33 ± 0.81	6.75 ± 6.39	43.82 ± 10.78	43.79 ± 11.32	3.77 ± 4.42	0.04 ± 0.06	0.02 ± 0.02
M-4	3.15 ± 3.64	0.94 ± 1.03	7.24 ± 11.25	39.66 ± 7.46	47.97 ± 16.67	0.96 ± 2.35	0.05 ± 0.04	0.02 ± 0.01
M-5	2.95 ± 3.90	2.60 ± 3.68	5.28 ± 6.54	38.30 ± 12.70	49.42 ± 16.24	1.11 ± 1.27	0.13 ± 0.16	0.06 ± 0.06
M-6	3.28 ± 2.58	0.00 ± 0.00	0.08 ± 0.19	35.01 ± 6.95	55.97 ± 6.29	5.82 ± 2.35	0.08 ± 0.07	0.11 ± 0.05
M-7	3.84 ± 3.63	1.44 ± 1.46	19.54 ± 27.22	39.19 ± 12.46	33.28 ± 19.44	2.54 ± 1.94	0.11 ± 0.13	0.06 ± 0.08
M-8	1.21 ± 0.56	0.59 ± 1.45	1.88 ± 4.13	41.21 ± 8.11	50.99 ± 11.32	4.03 ± 1.09	0.06 ± 0.02	0.07 ± 0.02
Sta 11								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.04 ± 0.05	0.00 ± 0.00	0.00 ± 0.00	3.16 ± 1.83	42.08 ± 14.19	54.54 ± 13.60	0.11 ± 0.04	0.06 ± 0.03
M-3	0.13 ± 0.11	0.00 ± 0.00	0.00 ± 0.00	4.27 ± 2.31	60.00 ± 6.41	34.40 ± 7.88	0.89 ± 1.14	0.32 ± 0.24
M-4	0.10 ± 0.11	0.00 ± 0.00	0.00 ± 0.00	3.95 ± 3.30	46.06 ± 7.47	48.68 ± 6.74	0.84 ± 0.38	0.37 ± 0.13
M-5	0.01 ± 0.02	0.00 ± 0.00	0.00 ± 0.00	1.14 ± 1.30	55.32 ± 4.63	41.72 ± 3.47	1.21 ± 0.46	0.53 ± 0.31
M-6	0.05 ± 0.06	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	53.51 ± 4.15	44.06 ± 3.86	1.45 ± 0.38	0.92 ± 0.18
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	0.02 ± 0.04	0.00 ± 0.00	1.34 ± 3.29	15.56 ± 35.97	44.11 ± 21.81	36.04 ± 17.85	1.58 ± 0.72	1.38 ± 0.44
Sta 12								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.56 ± 0.74	0.81 ± 2.00	33.02 ± 11.33	45.70 ± 6.95	16.98 ± 4.36	1.32 ± 3.22	1.23 ± 0.39	0.35 ± 0.11
M-3	1.72 ± 2.07	1.28 ± 1.55	33.14 ± 8.74	43.70 ± 8.20	18.32 ± 2.39	0.00 ± 0.00	1.40 ± 0.55	0.48 ± 0.10
M-4	0.09 ± 0.10	0.00 ± 0.00	28.10 ± 5.64	45.14 ± 4.33	17.32 ± 4.50	7.52 ± 1.46	1.48 ± 0.44	0.31 ± 0.08
M-5	0.76 ± 0.98	1.12 ± 1.53	19.89 ± 9.33	52.26 ± 4.95	20.46 ± 7.57	2.74 ± 1.54	2.15 ± 0.66	0.64 ± 0.18
M-6	0.34 ± 0.48	0.00 ± 0.00	15.68 ± 3.84	47.86 ± 2.42	25.41 ± 2.03	6.08 ± 0.74	3.34 ± 0.25	1.28 ± 0.21
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	0.07 ± 0.11	0.00 ± 0.00	19.94 ± 3.88	45.28 ± 2.86	18.08 ± 4.80	2.00 ± 0.61	0.09 ± 0.08	1.26 ± 0.25

TABLE F-1. (Continued)

	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay
Sta 13								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.19 ± 0.29	0.00 ± 0.00	5.31 ± 5.89	8.10 ± 3.50	22.98 ± 9.87	38.05 ± 6.35	22.09 ± 4.13	3.29 ± 1.09
M-3	0.28 ± 0.40	0.64 ± 1.56	3.15 ± 2.91	7.24 ± 1.76	18.56 ± 5.09	44.24 ± 3.75	22.83 ± 5.41	3.06 ± 1.03
M-4	0.02 ± 0.04	0.00 ± 0.00	0.72 ± 0.79	7.72 ± 3.02	14.10 ± 3.01	49.94 ± 4.17	23.60 ± 2.93	3.92 ± 0.58
M-5	0.00 ± 0.00	0.00 ± 0.00	0.10 ± 0.24	0.70 ± 0.78	9.27 ± 3.79	51.88 ± 4.31	32.92 ± 4.15	5.13 ± 1.11
M-6	0.02 ± 0.03	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	4.76 ± 3.91	53.71 ± 1.90	34.35 ± 2.84	6.62 ± 0.64
M-7	0.06 ± 0.07	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	8.12 ± 2.58	48.96 ± 3.78	35.62 ± 3.76	7.24 ± 0.69
M-8	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.17 ± 0.28	6.65 ± 1.64	47.28 ± 4.37	38.97 ± 3.13	6.93 ± 0.52
Sta 13A								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-3	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-4	0.03 ± 0.05	0.00 ± 0.00	0.00 ± 0.00	2.46 ± 1.51	4.17 ± 3.51	11.15 ± 2.46	70.73 ± 6.48	11.46 ± 1.33
M-5	0.02 ± 0.03	0.00 ± 0.00	0.00 ± 0.00	0.40 ± 0.44	3.46 ± 3.42	6.54 ± 2.18	83.88 ± 1.97	7.40 ± 1.43
M-6	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	6.86 ± 0.43	80.33 ± 1.59	12.81 ± 1.58
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	4.69 ± 1.18	83.44 ± 5.05	11.87 ± 4.73
Sta 14								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	2.35 ± 1.80	5.40 ± 7.54	56.70 ± 12.55	31.4 ± 6.55	1.47 ± 3.61	0.74 ± 1.80	1.32 ± 1.93	0.60 ± 0.83
M-3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
M-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
M-5	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-6	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Sta 14A								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-3	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-4	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-5	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.13 ± 0.33	2.15 ± 0.61	7.80 ± 1.86	73.76 ± 4.00	16.14 ± 3.14
M-6	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	10.88 ± 1.51	68.43 ± 1.46	20.69 ± 0.91
M-7	0.03 ± 0.06	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	10.82 ± 1.92	65.19 ± 2.92	23.96 ± 1.44
M-8	0.79 ± 1.71	0.13 ± 0.32	0.00 ± 0.00	0.66 ± 1.60	0.00 ± 0.00	9.96 ± 2.16	70.02 ± 6.18	18.44 ± 3.55

TABLE F-1. (Continued)

	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay
Sta 15								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	16.92 ± 19.69	0.21 ± 0.51	5.32 ± 4.86	45.01 ± 12.41	32.91 ± 9.26	0.41 ± 1.01	0.05 ± 0.10	0.01 ± 0.00
M-3	3.11 ± 3.06	1.52 ± 3.72	3.44 ± 4.23	62.60 ± 7.94	29.40 ± 8.82	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
M-4	4.13 ± 4.74	0.00 ± 0.00	3.78 ± 2.99	59.64 ± 8.24	32.47 ± 5.51	0.00 ± 0.00	0.00 ± 0.00	0.01 ± 0.01
M-5	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-6	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Sta 16								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	4.13 ± 1.97	14.26 ± 10.30	41.16 ± 9.09	33.08 ± 12.64	7.18 ± 3.96	0.00 ± 0.00	0.12 ± 0.05	0.06 ± 0.02
M-3	1.29 ± 2.02	12.00 ± 7.34	46.03 ± 7.05	33.86 ± 9.56	7.55 ± 1.95	0.00 ± 0.00	0.10 ± 0.05	0.12 ± 0.03
M-4	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-5	1.10 ± 0.59	12.07 ± 11.79	43.63 ± 11.74	36.13 ± 15.42	6.58 ± 5.89	0.00 ± 0.00	0.32 ± 0.30	0.16 ± 0.09
M-6	1.84 ± 2.07	2.78 ± 2.74	33.10 ± 5.43	44.64 ± 6.22	15.74 ± 3.20	0.80 ± 0.99	0.71 ± 0.29	0.40 ± 0.09
M-7	1.06 ± 0.74	6.28 ± 2.92	38.82 ± 8.98	40.04 ± 7.18	12.72 ± 5.06	0.66 ± 0.64	0.34 ± 0.24	0.15 ± 0.16
M-8	0.98 ± 0.63	5.89 ± 2.74	42.64 ± 2.85	38.05 ± 3.43	10.19 ± 2.13	1.55 ± 1.27	0.47 ± 0.09	0.24 ± 0.06
Sta 17								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	2.36 ± 1.66	14.50 ± 6.55	50.92 ± 6.68	31.11 ± 6.43	0.97 ± 1.62	0.00 ± 0.00	0.09 ± 0.02	0.07 ± 0.01
M-3	1.60 ± 0.93	3.43 ± 2.12	42.57 ± 7.06	40.78 ± 4.61	11.44 ± 3.02	0.00 ± 0.00	0.12 ± 0.12	0.06 ± 0.04
M-4	1.14 ± 1.18	0.64 ± 1.58	24.30 ± 13.02	51.06 ± 4.73	22.78 ± 12.67	0.00 ± 0.00	0.05 ± 0.04	0.04 ± 0.02
M-5	1.40 ± 1.06	1.49 ± 1.37	37.02 ± 9.14	47.77 ± 6.94	11.97 ± 3.13	0.16 ± 0.39	0.13 ± 0.11	0.08 ± 0.07
M-6	1.20 ± 0.43	0.00 ± 0.00	32.40 ± 5.86	47.45 ± 3.40	17.48 ± 5.28	1.03 ± 0.76	0.30 ± 0.21	0.15 ± 0.17
M-7	1.58 ± 0.92	3.58 ± 1.03	41.71 ± 4.58	41.32 ± 4.14	10.69 ± 2.25	0.74 ± 0.41	0.26 ± 0.21	0.14 ± 0.11
M-8	1.96 ± 1.19	2.21 ± 1.44	42.84 ± 5.82	40.10 ± 5.27	10.48 ± 1.93	1.92 ± 0.54	0.30 ± 0.17	0.19 ± 0.08
Sta 18								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.28 ± 0.35	0.00 ± 0.00	5.98 ± 3.50	52.81 ± 3.96	40.85 ± 2.68	0.00 ± 0.00	0.14 ± 0.05	0.09 ± 0.02
M-3	0.83 ± 1.26	0.00 ± 0.00	0.00 ± 0.00	60.61 ± 4.09	39.02 ± 4.12	0.00 ± 0.00	0.12 ± 0.02	0.10 ± 0.02
M-4	0.57 ± 0.87	0.00 ± 0.00	0.33 ± 0.81	47.33 ± 3.71	51.21 ± 3.55	0.33 ± 0.81	0.12 ± 0.04	0.06 ± 0.02
M-5	0.25 ± 0.38	0.00 ± 0.00	0.00 ± 0.00	48.45 ± 5.12	50.42 ± 5.04	0.33 ± 0.52	0.29 ± 0.11	0.25 ± 0.12
M-6	0.28 ± 0.38	0.00 ± 0.00	0.00 ± 0.00	40.11 ± 5.42	56.72 ± 5.45	2.07 ± 0.58	0.46 ± 0.14	0.35 ± 0.11
M-7	0.19 ± 0.10	0.00 ± 0.00	1.02 ± 0.70	49.04 ± 3.21	47.40 ± 4.14	1.63 ± 0.47	0.42 ± 0.10	0.33 ± 0.07
M-8	0.34 ± 0.27	0.00 ± 0.00	0.20 ± 0.33	45.94 ± 4.78	50.65 ± 5.01	2.16 ± 0.93	0.42 ± 0.15	0.30 ± 0.13

N.S. = No Sample
N.D. = No Data Available

TABLE F-2. SEDIMENT GRAIN SIZE ANALYSIS OF SITE-SPECIFIC STATIONS, SHOWING AVERAGE PERCENT COMPOSITION AND ONE STANDARD DEVIATION FOR EACH SIZE CLASS MEASURED.

	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay
Stn 5-1								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	2.49 ± 1.07	5.51 ± 2.24	45.09 ± 6.48	39.94 ± 6.34	6.83 ± 2.98	0.00 ± 0.00	0.10 ± 0.04	0.04 ± 0.00
M-3	3.09 ± 2.00	8.40 ± 3.15	51.51 ± 7.80	29.01 ± 10.54	8.07 ± 1.42	0.00 ± 0.00	0.05 ± 0.03	0.05 ± 0.03
M-4	5.95 ± 2.67	11.27 ± 2.18	47.16 ± 2.30	26.56 ± 3.79	7.34 ± 3.28	0.00 ± 0.00	0.21 ± 0.06	0.10 ± 0.03
M-5	4.12 ± 4.64	2.20 ± 1.49	39.64 ± 4.88	40.07 ± 5.63	10.54 ± 1.65	2.55 ± 0.71	0.60 ± 0.21	0.28 ± 0.08
M-6	2.52 ± 1.67	8.00 ± 1.89	51.12 ± 3.92	27.83 ± 3.88	8.06 ± 1.16	1.94 ± 0.38	0.64 ± 0.35	0.36 ± 0.16
M-7	2.28 ± 0.58	6.49 ± 0.74	49.70 ± 4.23	31.35 ± 4.79	8.17 ± 1.64	1.54 ± 0.37	0.32 ± 0.16	0.17 ± 0.07
M-8	4.82 ± 1.98	12.51 ± 6.46	45.17 ± 6.40	27.00 ± 1.67	7.06 ± 1.65	2.28 ± 0.77	0.80 ± 0.24	0.38 ± 0.13
Stn 5-2								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	2.06 ± 0.50	11.08 ± 7.62	58.05 ± 5.83	22.17 ± 4.03	5.39 ± 3.16	0.32 ± 0.80	0.07 ± 0.03	0.03 ± 0.01
M-3	0.85 ± 0.44	9.56 ± 5.77	58.89 ± 6.17	23.92 ± 5.98	6.27 ± 1.96	0.00 ± 0.00	0.10 ± 0.03	0.04 ± 0.02
M-4	2.70 ± 0.66	7.12 ± 4.72	37.82 ± 14.25	37.24 ± 12.34	11.98 ± 3.77	2.91 ± 3.82	0.15 ± 0.15	0.23 ± 0.31
M-5	2.26 ± 0.64	2.76 ± 1.52	40.01 ± 2.26	41.51 ± 2.01	9.70 ± 0.70	2.71 ± 1.36	0.59 ± 0.15	0.30 ± 0.07
M-6	3.05 ± 1.04	10.23 ± 2.74	48.28 ± 3.04	28.39 ± 2.59	7.37 ± 1.17	1.95 ± 0.73	0.51 ± 0.42	0.23 ± 0.13
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	1.47 ± 0.55	4.97 ± 1.04	45.08 ± 3.27	37.10 ± 2.60	8.88 ± 2.00	1.72 ± 1.05	0.46 ± 0.18	0.31 ± 0.13
Stn 5-3								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	4.68 ± 2.38	11.00 ± 6.42	48.73 ± 5.39	28.54 ± 6.39	6.99 ± 2.25	0.00 ± 0.00	0.07 ± 0.03	0.02 ± 0.01
M-3	2.80 ± 1.51	13.18 ± 5.29	46.99 ± 6.24	28.65 ± 5.18	7.73 ± 2.10	0.00 ± 0.00	0.11 ± 0.07	0.06 ± 0.04
M-4	1.02 ± 0.82	6.93 ± 7.10	45.76 ± 6.58	32.92 ± 8.86	12.49 ± 4.73	0.65 ± 1.60	0.16 ± 0.11	0.05 ± 0.04
M-5	0.32 ± 0.16	0.54 ± 0.68	39.72 ± 5.51	45.86 ± 2.74	10.74 ± 2.94	2.04 ± 0.84	0.46 ± 0.07	0.31 ± 0.15
M-6	3.82 ± 1.22	13.25 ± 5.51	46.48 ± 3.26	26.98 ± 5.08	6.57 ± 2.07	1.91 ± 0.59	0.62 ± 0.23	0.42 ± 0.14
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	1.47 ± 1.47	7.98 ± 7.46	44.98 ± 7.72	33.57 ± 8.40	9.26 ± 2.35	2.26 ± 0.74	0.33 ± 0.32	0.17 ± 0.11
Stn 5-4								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	1.07 ± 0.38	8.39 ± 3.86	54.82 ± 7.74	32.78 ± 8.98	2.80 ± 3.22	0.00 ± 0.00	0.07 ± 0.05	0.06 ± 0.02
M-3	1.36 ± 0.33	11.31 ± 2.30	52.30 ± 5.02	27.55 ± 4.69	7.22 ± 1.03	0.00 ± 0.00	0.19 ± 0.11	0.06 ± 0.04
M-4	0.96 ± 0.62	4.60 ± 2.38	46.40 ± 5.19	34.89 ± 2.77	12.84 ± 4.50	0.00 ± 0.00	0.20 ± 0.21	0.10 ± 0.08
M-5	1.47 ± 1.64	1.42 ± 1.44	37.75 ± 4.16	42.99 ± 3.77	12.23 ± 2.56	3.01 ± 1.12	0.48 ± 0.14	0.26 ± 0.11
M-6	2.39 ± 1.44	9.38 ± 3.98	49.39 ± 4.16	28.71 ± 4.18	7.74 ± 1.81	1.87 ± 0.77	0.32 ± 0.12	0.20 ± 0.06
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	1.50 ± 0.64	11.88 ± 5.72	48.33 ± 3.80	27.46 ± 6.61	7.49 ± 1.00	2.61 ± 0.94	0.43 ± 0.17	0.23 ± 0.08

TABLE F-2. (Continued)

	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay
Stn 5-5								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.81 ± 0.72	13.47 ± 13.44	42.83 ± 19.26	38.08 ± 23.40	4.66 ± 6.77	0.00 ± 0.00	0.10 ± 0.08	0.05 ± 0.04
M-3	0.86 ± 1.28	4.92 ± 4.43	45.47 ± 10.05	38.34 ± 7.69	10.29 ± 6.36	0.00 ± 0.00	0.13 ± 0.11	0.08 ± 0.09
M-4	0.79 ± 0.83	3.64 ± 2.33	49.92 ± 7.87	35.66 ± 3.44	9.87 ± 5.70	0.00 ± 0.00	0.09 ± 0.04	0.04 ± 0.03
M-5	0.53 ± 0.25	1.07 ± 0.62	32.88 ± 6.14	48.12 ± 4.90	13.76 ± 2.63	2.98 ± 0.43	0.30 ± 0.21	0.36 ± 0.14
M-6	0.43 ± 0.26	4.78 ± 1.11	49.14 ± 2.78	34.57 ± 2.04	9.68 ± 2.06	1.01 ± 0.48	0.23 ± 0.07	0.16 ± 0.06
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	0.76 ± 0.48	4.92 ± 1.64	49.13 ± 4.48	27.00 ± 1.67	8.15 ± 2.62	1.80 ± 0.60	0.20 ± 0.07	0.17 ± 0.04
Stn 5-6								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	1.28 ± 0.46	4.60 ± 1.49	51.77 ± 3.14	35.51 ± 4.21	6.74 ± 1.30	0.00 ± 0.00	0.06 ± 0.02	0.04 ± 0.02
M-3	1.08 ± 0.71	7.56 ± 5.15	53.84 ± 6.06	32.81 ± 7.36	3.79 ± 3.23	0.00 ± 0.00	0.06 ± 0.02	0.02 ± 0.02
M-4	1.80 ± 1.50	1.97 ± 1.97	48.27 ± 7.19	38.36 ± 6.46	9.39 ± 1.52	0.00 ± 0.00	0.15 ± 0.11	0.06 ± 0.03
M-5	0.65 ± 0.21	0.47 ± 0.63	34.60 ± 3.24	48.05 ± 2.60	12.30 ± 1.70	3.07 ± 0.72	0.47 ± 0.12	0.40 ± 0.14
M-6	1.01 ± 0.70	7.38 ± 5.06	52.42 ± 6.08	31.22 ± 7.82	6.24 ± 2.61	1.02 ± 0.42	0.41 ± 0.18	0.30 ± 0.14
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	0.22 ± 0.15	1.81 ± 1.02	47.57 ± 4.46	37.10 ± 2.60	8.46 ± 1.89	1.74 ± 0.24	0.26 ± 0.17	0.13 ± 0.08
Stn 5-8								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	9.95 ± 5.35	14.70 ± 3.07	42.41 ± 6.61	25.79 ± 3.94	6.34 ± 2.69	0.61 ± 1.50	0.13 ± 0.06	0.06 ± 0.01
M-3	3.91 ± 3.23	10.13 ± 6.42	42.12 ± 5.12	31.98 ± 6.16	11.48 ± 2.15	0.00 ± 0.00	0.22 ± 0.17	0.16 ± 0.08
M-4	5.02 ± 3.47	11.68 ± 3.64	49.35 ± 4.41	26.21 ± 2.44	7.56 ± 1.63	0.00 ± 0.00	0.17 ± 0.08	0.09 ± 0.04
M-5	4.19 ± 1.92	6.48 ± 2.19	37.30 ± 1.47	35.59 ± 3.22	11.41 ± 2.12	3.88 ± 0.45	0.74 ± 0.18	0.43 ± 0.13
M-6	4.92 ± 3.17	11.25 ± 6.79	44.15 ± 5.25	29.12 ± 9.67	7.72 ± 1.47	1.98 ± 0.66	0.54 ± 0.31	0.38 ± 0.26
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	4.58 ± 1.63	12.77 ± 3.68	45.75 ± 3.16	25.62 ± 2.54	7.14 ± 0.56	3.18 ± 0.99	0.65 ± 0.29	0.36 ± 0.13
Stn 5-9								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	4.29 ± 1.42	18.44 ± 5.59	48.88 ± 7.02	19.72 ± 3.29	8.44 ± 1.97	0.00 ± 0.00	0.14 ± 0.05	0.05 ± 0.01
M-3	2.62 ± 1.07	17.87 ± 11.43	48.53 ± 7.38	24.21 ± 4.10	6.80 ± 5.32	0.00 ± 0.00	0.22 ± 0.12	0.07 ± 0.02
M-4	1.36 ± 0.51	10.31 ± 6.66	54.02 ± 4.99	25.02 ± 6.58	8.83 ± 1.11	0.00 ± 0.00	0.31 ± 0.11	0.15 ± 0.08
M-5	1.73 ± 0.89	4.27 ± 1.52	39.92 ± 3.15	37.16 ± 2.10	12.95 ± 2.25	3.03 ± 0.80	0.61 ± 0.07	0.37 ± 0.13
M-6	2.48 ± 1.17	12.46 ± 7.52	49.21 ± 2.74	25.15 ± 4.44	7.17 ± 1.52	2.17 ± 0.84	0.84 ± 0.22	0.56 ± 0.14
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	2.99 ± 0.94	10.48 ± 3.01	48.95 ± 2.69	24.96 ± 2.09	8.26 ± 1.79	2.91 ± 1.08	0.96 ± 0.55	0.52 ± 0.24

TABLE F-2. (Continued)

	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay
Stn 5-10								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	1.02 ± 0.78	6.58 ± 3.15	53.99 ± 3.10	27.82 ± 1.86	10.37 ± 2.94	0.00 ± 0.00	0.15 ± 0.06	0.07 ± 0.02
M-3	0.80 ± 0.63	9.90 ± 1.20	50.54 ± 3.25	30.40 ± 3.83	8.25 ± 1.91	0.00 ± 0.00	0.08 ± 0.04	0.02 ± 0.01
M-4	0.53 ± 0.43	4.63 ± 2.97	50.29 ± 4.96	33.42 ± 4.60	10.92 ± 2.74	0.00 ± 0.00	0.13 ± 0.09	0.08 ± 0.07
M-5	0.49 ± 0.31	2.77 ± 1.33	41.67 ± 4.17	38.56 ± 3.62	12.67 ± 3.66	2.67 ± 0.70	0.70 ± 0.26	0.48 ± 0.18
M-6	1.12 ± 0.72	10.53 ± 3.47	52.85 ± 3.02	24.87 ± 2.51	7.62 ± 1.54	1.93 ± 0.54	0.62 ± 0.15	0.48 ± 0.12
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	1.05 ± 0.84	6.52 ± 3.10	52.95 ± 3.69	27.61 ± 5.82	7.94 ± 0.98	2.92 ± 0.68	0.66 ± 0.41	0.34 ± 0.19
Stn 5-11								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.60 ± 0.95	6.10 ± 3.12	49.96 ± 7.58	34.57 ± 7.48	8.61 ± 2.44	0.00 ± 0.00	0.16 ± 0.08	0.05 ± 0.02
M-3	0.15 ± 0.10	2.16 ± 1.60	39.39 ± 6.95	41.22 ± 3.99	15.29 ± 3.50	1.33 ± 2.06	0.10 ± 0.07	0.04 ± 0.02
M-4	0.28 ± 0.17	4.31 ± 3.19	49.06 ± 7.14	35.45 ± 6.17	10.60 ± 2.98	0.00 ± 0.00	0.23 ± 0.09	0.07 ± 0.04
M-5	0.27 ± 0.25	1.24 ± 0.97	40.57 ± 6.56	41.44 ± 3.91	12.82 ± 3.10	2.50 ± 0.72	0.75 ± 0.09	0.40 ± 0.03
M-6	0.15 ± 0.12	4.94 ± 0.79	49.66 ± 2.64	32.58 ± 0.59	10.28 ± 1.61	1.57 ± 0.48	0.44 ± 0.22	0.30 ± 0.18
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	0.72 ± 0.51	4.32 ± 2.72	46.47 ± 2.35	35.20 ± 3.85	11.04 ± 1.74	2.05 ± 1.05	0.16 ± 0.07	0.10 ± 0.02
Stn 5-12								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	1.08 ± 0.58	6.74 ± 3.24	55.31 ± 7.22	30.79 ± 6.62	5.93 ± 2.73	0.00 ± 0.00	0.06 ± 0.02	0.04 ± 0.02
M-3	0.23 ± 0.13	1.33 ± 1.63	32.55 ± 19.60	48.20 ± 18.54	17.62 ± 5.56	0.00 ± 0.00	0.03 ± 0.03	0.02 ± 0.02
M-4	0.20 ± 0.15	3.98 ± 6.28	31.55 ± 16.32	45.17 ± 13.98	18.92 ± 8.88	0.00 ± 0.00	0.13 ± 0.11	0.05 ± 0.03
M-5	0.18 ± 0.19	0.59 ± 0.95	23.92 ± 18.71	48.51 ± 7.85	24.09 ± 12.06	1.95 ± 0.59	0.35 ± 0.19	0.28 ± 0.13
M-6	1.91 ± 2.77	6.13 ± 6.23	29.07 ± 14.54	43.39 ± 15.34	17.01 ± 7.08	1.73 ± 0.87	0.49 ± 0.37	0.30 ± 0.18
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	0.94 ± 0.68	2.56 ± 2.29	30.68 ± 12.83	45.56 ± 10.76	18.08 ± 4.80	2.00 ± 0.61	0.09 ± 0.08	0.11 ± 0.07
Stn 5-14								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.55 ± 0.46	4.63 ± 2.56	60.73 ± 5.62	32.12 ± 5.66	1.82 ± 2.84	0.00 ± 0.00	0.08 ± 0.05	0.07 ± 0.06
M-3	0.26 ± 0.11	3.98 ± 3.08	51.92 ± 9.82	35.01 ± 8.40	7.63 ± 3.44	0.33 ± 0.81	0.15 ± 0.06	0.05 ± 0.01
M-4	0.15 ± 0.06	1.66 ± 2.33	55.46 ± 8.75	35.87 ± 7.25	6.64 ± 3.00	0.00 ± 0.00	0.14 ± 0.09	0.07 ± 0.02
M-5	0.28 ± 0.12	0.16 ± 0.40	41.35 ± 4.13	43.58 ± 3.30	11.72 ± 0.99	1.96 ± 0.59	0.53 ± 0.07	0.41 ± 0.08
M-6	1.31 ± 2.04	4.79 ± 2.09	56.58 ± 4.86	30.27 ± 1.99	5.50 ± 1.52	1.04 ± 0.45	0.35 ± 0.29	0.16 ± 0.06
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	0.42 ± 0.28	2.54 ± 2.16	54.38 ± 2.91	34.34 ± 3.60	6.46 ± 1.10	1.62 ± 0.49	0.15 ± 0.06	0.12 ± 0.04

TABLE F-2. (Continued)

	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay
Stn 5-16								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	5.08 ± 3.45	8.14 ± 4.30	44.35 ± 10.18	28.90 ± 7.55	13.43 ± 8.64	0.00 ± 0.00	0.06 ± 0.03	0.03 ± 0.01
M-3	6.14 ± 3.28	11.11 ± 4.95	36.09 ± 5.25	30.99 ± 6.94	15.40 ± 6.22	0.00 ± 0.00	0.20 ± 0.16	0.06 ± 0.04
M-4	3.30 ± 3.00	15.46 ± 14.80	46.02 ± 6.78	27.88 ± 9.98	6.98 ± 4.30	0.00 ± 0.00	0.30 ± 0.18	0.06 ± 0.02
M-5	2.76 ± 1.11	8.41 ± 5.29	38.85 ± 5.97	33.12 ± 2.51	13.11 ± 5.51	2.61 ± 1.24	0.73 ± 0.22	0.42 ± 0.12
M-6	6.51 ± 3.38	10.85 ± 5.25	34.37 ± 4.54	33.87 ± 7.71	12.26 ± 3.82	1.83 ± 0.62	0.26 ± 0.09	0.14 ± 0.06
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	2.92 ± 2.00	8.93 ± 5.94	44.23 ± 17.48	29.67 ± 13.35	11.71 ± 10.28	2.03 ± 0.63	0.30 ± 0.29	0.22 ± 0.09
Stn 5-18								
M-1	N.S. N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	
M-2	0.68 ± 0.58	4.94 ± 3.63	51.71 ± 7.45	30.77 ± 7.16	11.58 ± 4.06	0.00 ± 0.00	0.10 ± 0.03	0.04 ± 0.01
M-3	1.38 ± 1.74	8.78 ± 4.72	50.14 ± 6.64	26.25 ± 4.97	13.16 ± 4.24	0.00 ± 0.00	0.21 ± 0.12	0.06 ± 0.04
M-4	0.51 ± 0.24	5.28 ± 6.57	53.90 ± 10.65	31.43 ± 8.96	8.61 ± 6.39	0.00 ± 0.00	0.18 ± 0.10	0.09 ± 0.02
M-5	0.59 ± 0.30	1.80 ± 1.84	43.78 ± 5.35	38.25 ± 4.97	11.96 ± 2.24	2.61 ± 0.55	0.66 ± 0.20	0.37 ± 0.08
M-6	1.23 ± 0.45	7.19 ± 1.30	51.60 ± 2.94	28.73 ± 1.19	9.00 ± 1.81	1.60 ± 0.78	0.43 ± 0.16	0.41 ± 0.25
M-7	1.41 ± 1.39	8.81 ± 4.56	52.24 ± 5.92	26.82 ± 2.60	8.28 ± 1.35	1.56 ± 0.40	0.60 ± 0.37	0.30 ± 0.16
M-8	0.96 ± 0.78	2.54 ± 1.21	52.00 ± 3.30	31.51 ± 4.45	9.58 ± 1.11	2.70 ± 0.66	0.46 ± 0.28	0.25 ± 0.14
Stn 5-20								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	4.36 ± 2.70	22.04 ± 13.06	37.40 ± 12.42	27.14 ± 13.25	5.30 ± 2.36	0.00 ± 0.00	0.06 ± 0.02	0.04 ± 0.02
M-3	0.30 ± 0.22	1.33 ± 1.03	25.90 ± 10.46	54.14 ± 9.21	17.94 ± 5.69	0.33 ± 0.81	0.04 ± 0.03	0.02 ± 0.01
M-4	0.32 ± 0.41	3.30 ± 4.08	39.45 ± 11.70	53.73 ± 9.72	2.99 ± 3.94	0.00 ± 0.00	0.14 ± 0.14	0.07 ± 0.05
M-5	0.44 ± 0.40	1.02 ± 0.87	29.34 ± 11.19	52.44 ± 7.56	14.90 ± 5.18	1.45 ± 0.53	0.25 ± 0.12	0.20 ± 0.08
M-6	0.25 ± 0.26	1.03 ± 0.92	31.66 ± 6.65	53.38 ± 5.31	12.37 ± 3.63	1.11 ± 0.83	0.12 ± 0.12	0.09 ± 0.03
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	1.01 ± 1.00	2.12 ± 3.19	34.30 ± 18.68	48.89 ± 17.30	12.20 ± 5.95	1.50 ± 0.67	0.00 ± 0.00	0.00 ± 0.00
Stn 5-22								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	0.09 ± 0.11	4.66 ± 4.11	61.72 ± 3.36	32.28 ± 4.42	1.16 ± 2.04	0.00 ± 0.00	0.06 ± 0.02	0.03 ± 0.01
M-3	2.00 ± 4.08	3.49 ± 3.20	56.28 ± 7.63	31.48 ± 8.75	6.76 ± 3.87	0.00 ± 0.00	0.22 ± 0.21	0.17 ± 0.08
M-4	0.89 ± 1.79	3.26 ± 5.59	54.10 ± 5.86	36.69 ± 6.91	4.94 ± 4.12	0.00 ± 0.00	0.12 ± 0.12	0.04 ± 0.04
M-5	0.15 ± 0.11	0.44 ± 0.47	44.69 ± 1.72	42.35 ± 1.88	9.15 ± 1.06	1.90 ± 0.42	0.75 ± 0.31	0.58 ± 0.19
M-6	0.30 ± 0.31	6.23 ± 1.81	59.39 ± 2.31	27.63 ± 1.97	4.39 ± 0.68	1.19 ± 0.68	0.55 ± 0.24	0.32 ± 0.26
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	0.12 ± 0.05	1.99 ± 1.84	55.08 ± 6.14	35.61 ± 6.30	4.81 ± 1.61	2.02 ± 0.28	0.22 ± 0.16	0.14 ± 0.03

TABLE F-2. (Continued)

	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay
Stn 5-25								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	1.61 ± 2.08	0.66 ± 1.02	43.99 ± 8.58	36.28 ± 3.33	17.28 ± 4.79	0.00 ± 0.00	0.07 ± 0.02	0.05 ± 0.02
M-3	0.48 ± 0.51	4.46 ± 1.90	45.66 ± 9.75	33.70 ± 4.10	14.35 ± 5.11	0.98 ± 1.97	0.21 ± 0.08	0.16 ± 0.09
M-4	0.43 ± 0.74	0.33 ± 0.81	43.42 ± 9.42	42.72 ± 6.83	12.92 ± 4.84	0.00 ± 0.00	0.12 ± 0.08	0.05 ± 0.06
M-5	0.24 ± 0.14	0.51 ± 0.80	38.02 ± 3.64	41.78 ± 4.68	14.60 ± 2.27	3.41 ± 0.59	0.80 ± 0.18	0.65 ± 0.18
M-6	0.87 ± 0.51	2.28 ± 0.48	45.41 ± 4.05	35.29 ± 2.15	13.30 ± 3.18	1.87 ± 0.91	0.56 ± 0.27	0.43 ± 0.14
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	0.32 ± 0.20	2.87 ± 1.44	42.60 ± 5.28	37.03 ± 3.34	13.48 ± 1.73	2.93 ± 1.60	0.47 ± 0.32	0.33 ± 0.13
Stn 5-28								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	5.86 ± 3.79	15.29 ± 8.67	47.17 ± 6.80	27.85 ± 6.86	3.76 ± 2.37	0.00 ± 0.00	0.04 ± 0.02	0.02 ± 0.01
M-3	3.92 ± 1.38	8.59 ± 3.28	48.45 ± 5.82	32.81 ± 5.36	5.72 ± 2.36	0.00 ± 0.00	0.33 ± 0.20	0.17 ± 0.09
M-4	6.89 ± 4.00	4.73 ± 4.60	48.21 ± 6.44	36.68 ± 10.86	3.35 ± 2.07	0.00 ± 0.00	0.09 ± 0.06	0.03 ± 0.02
M-5	3.36 ± 2.13	3.96 ± 1.93	42.90 ± 5.93	40.24 ± 4.35	7.25 ± 1.53	1.44 ± 0.44	0.56 ± 0.36	0.35 ± 0.18
M-6	4.60 ± 4.64	16.50 ± 14.64	46.83 ± 12.09	27.29 ± 6.37	3.34 ± 1.06	0.90 ± 0.47	0.42 ± 0.58	0.23 ± 0.23
M-7	4.08 ± 1.92	13.83 ± 10.31	53.79 ± 8.44	24.44 ± 4.86	2.75 ± 0.37	0.86 ± 0.32	0.17 ± 0.28	0.08 ± 0.07
M-8	5.18 ± 1.99	8.59 ± 5.07	49.14 ± 4.67	30.14 ± 6.87	4.81 ± 1.43	1.70 ± 0.72	0.34 ± 0.26	0.13 ± 0.09
Stn 5-29								
M-1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-2	3.96 ± 3.80	0.94 ± 1.04	4.94 ± 2.69	25.90 ± 5.40	49.02 ± 7.30	14.59 ± 10.24	0.44 ± 0.21	0.22 ± 0.12
M-3	4.40 ± 3.00	0.94 ± 1.02	5.04 ± 2.22	26.18 ± 5.10	51.47 ± 4.79	11.05 ± 1.66	0.65 ± 0.19	0.25 ± 0.06
M-4	5.21 ± 2.67	0.00 ± 0.00	3.46 ± 2.55	24.98 ± 2.28	53.98 ± 3.18	11.27 ± 3.69	0.81 ± 0.36	0.29 ± 0.10
M-5	5.23 ± 3.88	0.00 ± 0.00	1.12 ± 0.98	20.66 ± 5.98	53.57 ± 4.99	16.26 ± 1.89	2.05 ± 0.43	1.12 ± 0.20
M-6	6.02 ± 4.81	0.25 ± 0.28	3.41 ± 1.06	29.15 ± 2.86	47.29 ± 4.88	11.47 ± 1.02	1.56 ± 0.25	0.91 ± 0.11
M-7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M-8	5.06 ± 2.00	0.09 ± 0.23	3.26 ± 1.24	25.78 ± 4.46	49.23 ± 6.13	14.19 ± 2.23	1.54 ± 0.26	0.85 ± 0.06

N.S. = No sample.

APPENDIX G

TABLE G-1. SURFACE AND BOTTOM TEMPERATURES (°C) FROM XBT RECORDS FROM GEORGES BANK BENTHIC MONITORING PROGRAM REGIONAL STATIONS.

Stn.	Cruise M-5		Cruise M-6		Cruise M-7		Cruise M-8	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
1	15.6	9.5	11.4	13.7	*	*	11.0	8.2
2	16.3	6.8	10.7	10.6	*	*	*	*
3	15.8	12.4	15.0	13.0	*	*	8.0	10.2
4	15.3	9.7	*	*	*	*	*	*
5	*	*	12.0	11.1	*	*	9.0	6.5
6	17.6	12.5	*	*	*	*	9.1	10.0
7A	18.7	8.8	12.2	13.4	*	*	9.3	11.4
8	18.3	10.8	14.7	11.2	*	*	11.7	11.3
9	19.6	11.4	11.8	12.5	*	*	9.0	10.1
10	13.0	10.7	11.3	11.5	*	*	*	*
11	19.3	10.5	10.8	12.8	*	*	8.6	6.8
12	19.4	11.5	12.0	13.0	*	*	9.3	10.4
13	17.8	12.5	12.4	15.0	*	*	10.0	7.5
13A	18.8	12.3	11.8	15.0	*	*	10.6	7.9
14A	16.6	5.0	*	*	*	*	8.4	6.0
15	17.3	15.3	*	*	*	*	*	*
16	19.5	12.4	15.7	13.0	6.3	9.8	10.2	12.5
17	*	*	15.6	12.9	*	*	13.1	12.0
18	20.0	11.4	13.9	15.9	*	*	11.3	12.0

*XBT malfunction/XBT not deployed.

TABLE G-2. DISSOLVED OXYGEN (mg/l) FROM GEORGES BANK BENTHIC MONITORING PROGRAM REGIONAL STATIONS FOR CRUISES M-5 AND M-6.

Sta.	Cruise M-5 Rep. 1	Cruise M-5 Rep. 2	Cruise M-5 Rep. 3	Cruise M-6 Rep. 1	Cruise M-6 Rep. 2	Cruise M-6 Rep. 3
1	8.77	8.99	8.90	8.75	8.36	8.67
2	8.50	8.50	8.51	8.36	8.31	8.37
3	6.30	6.32	6.31	7.21	7.30	7.34
4	9.04	8.94	9.04	8.14	8.28	8.15
5	7.55	7.79	7.99	7.25	7.32	7.28
6	6.11	6.31	6.13	6.09	6.25	6.28
7A	5.93	5.89	6.02	6.55	6.13	6.10
8	6.36	6.35	6.36	6.57	6.23	6.33
9	5.77	5.59	5.72	5.71	5.87	5.80
10	8.87	9.20	9.25	8.40	8.24	8.26
11	7.79	7.78	7.82	6.43	6.65	6.57
12	6.19	6.50	6.44	7.37	7.48	7.36
13	6.77	6.71	6.73	6.51	6.60	6.47
13A	6.92	6.11	6.11	6.32	6.36	6.31
14A	6.77	6.40	6.68	8.45	8.33	8.72
15	8.33	8.43	8.31	8.73	8.70	8.88
16	6.12	6.01	6.13	5.69	5.75	5.71
17	6.12	6.15	6.06	5.72	5.68	5.77
18	5.55	5.56	5.61	5.57	5.65	5.66

TABLE G-3. DISSOLVED OXYGEN (mg/l) FROM GEORGES BANK BENTHIC MONITORING PROGRAM REGIONAL STATIONS FOR CRUISES M-7 AND M-8.

Sta.		Cruise M-7 Rep. 1	Cruise M-7 Rep. 2	Cruise M-7 Rep. 3		Cruise M-8 Rep. 1	Cruise M-8 Rep. 2	Cruise M-8 Rep. 3
1	W	10.54	9.61	9.70	W	9.66	9.89	9.89
	P	8.37	7.91	8.00	P	9.06	9.02	9.02
2	W	9.20	9.33	9.33	W	9.85	9.94	9.82
	P	8.19	8.08	8.04	P	8.77	8.73	9.72
3	W	8.08	8.02	8.20	W	8.64	8.51	8.82
	P	7.23	7.00	6.95	P	8.04	8.01	7.97
4	W	**	**	**	W	11.08	9.40	9.35
	P	**	**	**	P	8.57	8.46	8.25
5	W	9.30	9.27	9.38	W	8.85	8.96	9.07
	P	8.39	8.35	8.33	P	8.42	8.24	8.33
6	W	7.91	7.98	8.01	W	7.33	7.83	7.84
	P	7.25	7.20	7.25	P	7.43	7.36	7.36
7A	W	6.06	6.27	6.22	W	6.25	6.29	6.02
	P	5.95	5.94	5.78	P	5.96	5.90	5.86
8	W	7.40	7.21	7.23	W	5.87	6.00	6.05
	P	6.24	6.28	6.21	P	5.61	5.86	5.75
9	W	**	**	**	W	6.83	6.84	6.74
	P	**	**	**	P	6.23	6.18	6.13
10	W	10.00	9.81	10.35	W	9.56	9.53	9.79
	P	8.26	8.30	8.21	P	6.13	6.12	6.07
11	W	**	**	**	W	9.25	9.22	9.33
	P	**	**	**	P	8.08	8.04	8.00
12	W	**	**	**	W	8.15	8.38	8.24
	P	**	**	**	P	5.40	5.34	5.32
13	W	9.90	10.09	9.90	W	9.28	9.29	8.95
	P	8.63	8.57	8.78	P	8.18	8.12	8.07
13A	W	**	**	**	W	9.00	8.57	8.40
	P	**	**	**	P	5.42	5.45	5.39
14A	W	6.49	6.74	6.47	W	8.52	8.37	8.20
	P	5.97	5.67	5.98	P	9.00	9.08	9.04
15	W	9.65	9.70	9.70	W	9.13	9.09	9.19
	P	8.77	8.21	8.39	P	8.86	8.84	8.84
16	W	6.95	6.99	7.03	W	6.35	6.40	6.52
	P	6.37	6.37	6.38	P	6.12	6.00	6.17
17	W	7.76	7.81	6.72	W	5.46	5.56	5.55
	P	6.17	6.16	6.18	P	6.18	6.00	5.97
18	W	**	**	**	W	6.33	6.35	6.46
	P	**	**	**	P	6.69	6.57	6.54

*W and P indicate data obtained by Winkler method or with probe.
**No sample/data at this station.

TABLE G-4. SALINITY (o/oo) FROM GEORGES BANK BENTHIC MONITORING PROGRAM REGIONAL STATIONS.

Station	Cruise M-5		Cruise M-6		Cruise M-7		Cruise M-8	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
1	32.4	32.6	32.5	32.5	31.4	31.6	31.5	32.2
2	32.0	32.9	32.0	32.7	*	31.6	31.4	31.7
3	32.4	35.0	32.2	33.0	31.1	31.5	32.0	32.5
4	32.6	32.9	32.6	33.0	*	*	31.4	32.0
5-1	32.7	33.6	32.5	33.0	31.6	32.3	31.6	32.2
6	33.2	35.1	33.0	33.5	31.2	31.8	32.0	32.3
7A	34.0	35.3	33.1	33.7	31.4	32.1	32.3	33.4
8	33.6	35.2	33.6	34.0	32.1	32.5	32.5	33.5
9	33.5	35.5	33.3	34.2	*	*	33.2	34.1
10	32.8	32.8	32.6	32.6	31.0	31.2	31.4	32.1
11	33.8	33.7	33.1	33.4	*	*	32.2	33.0
12	34.7	35.1	32.8	33.5	*	*	31.5	32.4
13	33.2	34.4	32.0	33.8	31.5	32.2	31.9	32.4
13A	33.2	34.4	33.2	33.7	*	*	32.1	32.5
14A	31.9	33.7	32.4	32.6	*	*	31.7	32.4
15	32.4	32.3	32.2	32.6	31.7	32.4	*	*
16	34.2	35.4	*	*	32.0	32.5	32.4	33.2
17	34.0	35.3	*	*	32.2	32.5	32.2	34.6
18	34.2	35.4	*	*	32.5	*	32.7	34.5

*No Data Available.

APPENDIX H

TABLE H-1. DOMINANT SPECIES AT REGIONAL STATION 1 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1

Echinarachnius parma
Polygordius sp. A
Pseudunciola obliquua
Tellina agilis
Tanaissus lilljeborgi
Bathyporeia quoddyensis
Rhepoxynius hudsoni
Protohaustorius wigleyi
Schistomeringos caeca
Exogone hebes

M-2

Polygordius sp. A
Pseudunciola obliquua
Tanaissus lilljeborgi
Spisula solidissima
Protohaustorius wigleyi
Bathyporeia quoddyensis
Echinarachnius parma
Schistomeringos caeca
Tellina agilis
Streptosyllis varians

M-3

Tellina agilis
Pseudunciola obliquua
Tanaissus lilljeborgi
Polygordius sp. A
Protohaustorius wigleyi
Rhepoxynius hudsoni
Bathyporeia quoddyensis
Echinarachnius parma
Spisula solidissima
Nephtys bucera

M-4

Capitella spp.
Tanaissus lilljeborgi
Protohaustorius wigleyi
Polygordius sp. A
Capitella jonesi
Tellina agilis
Rhepoxynius hudsoni
Pseudunciola obliquua
Echinarachnius parma
Pseudohaustorius caroliniensis

M-5

Tanaissus lilljeborgi
Protohaustorius wigleyi
Pseudunciola obliquua
Tellina agilis
Echinarachnius parma
Bathyporeia quoddyensis
Capitella jonesi
Polygordius sp. A
Rhepoxynius hudsoni
Spiophanes bombyx

M-6

Polygordius sp. A
Tanaissus lilljeborgi
Protohaustorius wigleyi
Pseudunciola obliquua
Bathyporeia quoddyensis
Rhepoxynius hudsoni
Spisula solidissima
Tellina agilis
Pseudohaustorius caroliniensis
Echinarachnius parma

M-7

Tanaissus lilljeborgi
Echinarachnius parma
Protohaustorius wigleyi
Pseudunciola obliquua
Bathyporeia quoddyensis
Tellina agilis
Polygordius sp. A
Rhepoxynius hudsoni
Spisula solidissima
Pseudohaustorius caroliniensis

M-8

Echinarachnius parma
Tannaissus lilljeborgi
Protohaustorius wigleyi
Rhepoxynius hudsoni
Bathyporeia quoddyensis
Nephtys bucera
Spiophanes bombyx
Polygordius sp. A
Pseudohaustorius caroliniensis
Nemertea sp. A

TABLE H-2. DOMINANT SPECIES AT REGIONAL STATION 2 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Parapionosyllis longicirrata	Parapionosyllis longicirrata
Exogone hebes	Byblis serrata
Echinarachnius parma	Exogone hebes
Exogone verugera	Exogone verugera
Sphaerosyllis cf. brevifrons	Polygordius sp. A
Peosidrilus biprostatus	Peosidrilus biprostatus
Streptosyllis arenae	Sphaerosyllis cf. brevifrons
Polygordius sp. A	Streptosyllis arenae
Spiophanes bombyx	Tharyx sp. A
Hesionura elongata	Hesionura elongata
M-3	**M-4**
Parapionosyllis longicirrata	Parapionosyllis longicirrata
Sphaerosyllis cf. brevifrons	Echinarachnius parma
Exogone verugera	Exogone hebes
Exogone hebes	Peosidrilus biprostatus
Peosidrilus biprostatus	Byblis serrata
Streptosyllis arenae	Streptosyllis arenae
Syllides benedicti	Exogone verugera
Tharyx sp. A	Syllides benedicti
Schistomeringos caeca	Sphaerosyllis cf. brevifrons
Byblis serrata	Hesionura elongata
M-5	**M-6**
Parapionosyllis longicirrata	Parapionosyllis longicirrata
Exogone hebes	Byblis serrata
Echinarachnius parma	Sphaerosyllis cf. brevifrons
Exogone verugera	Exogone verugera
Sphaerosyllis cf. brevifrons	Polygordius sp. A
Peosidrilus biprostatus	Exogone hebes
Streptosyllis arenae	Peosidrilus biprostatus
Spiophanes bombyx	Euclymene sp. A
Chaetozone n. sp. A	Aricidea (Acmira) cerruti
Erichthonius rubricornis	Unciola irrorata
M-7	**M-8**
Byblis serrata	Byblis serrata
Parapionosyllis longicirrata	Parapionosyllis longicirrata
Sphaerosyllis cf. brevifrons	Sphaerosyllis cf. brevifrons
Exogone verugera	Exogone hebes
Exogone hebes	Exogone verugera
Peosidrilus biprostatus	Syllides benedicti
Syllides benedicti	Streptosyllis arenae
Polygordius sp. A	Polygordius sp. A
Streptosyllis arenae	Peosidrilus biprostatus
Goniadella gracilis	Tharyx sp. A

TABLE H-3. DOMINANT SPECIES AT REGIONAL STATION 3 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Notomastus latericeus	Polygordius sp. A
Arctica islandica	Notomastus latericeus
Ampelisca agassizi	Protodorvillea gaspeensis
Protodorvillea gaspeensis	Euchone hancocki
Unciola inermis	Paraonis n. sp. A
Scalibregma inflatum	Ampelisca agassizi
Erichthonius rubricornis	Scoloplos rubricornis
Harmothoe extenuata	Erichthonius rubricornis
Polygordius sp. A	Arctica islandica
Paraonis n. sp. A	Exogone hebes
M-3	**M-4**
Polygordius sp. A	Notomastus latericeus
Notomastus latericeus	Polygordius sp. A
Protodorvillea gaspeensis	Unciola inermis
Arctica islandica	Ampelisca agassizi
Ampelisca agassizi	Aglaophamus circinata
Erichthonius rubricornis	Erichthonius rubricornis
Paraonis n. sp. A	Scalibregma inflatum
Spiophanes kroeyeri	Exogone hebes
Apistobranchus tullbergi	Protodorvillea gaspeensis
Nucula delphinodonta	Paraonis n. sp. A
M-5	**M-6**
Erichthonius rubricornis	Erichthonius rubricornis
Aglaophamus circinata	Notomastus latericeus
Notomastus latericeus	Ampelisca agassizi
Protodorvillea gaspeensis	Polygordius sp. A
Polygordius ap. A	Protodorvillea gaspeensis
Apistobranchus tullbergi	Paraonis n. sp. A
Ampelisca agassizi	Aglaophamus circinata
Exogone hebes	Exogone hebes
Unciola inermis	Tubificoides n. sp. A
Paraonis n. sp. A	Apistobranchus tullbergi
M-7	**M-8**
Erichthonius rubricornis	Erichthonius rubricornis
Protodorvillea gaspeensis	Notomastus latericeus
Notomastus latericeus	Unciola inermis
Ampelisca agassizi	Protodorvillea gaspeensis
Aglaophamus circinata	Aglaophamus circinata
Paraonis n. sp. A	Spio cf. armata
Exogone hebes	Ampelisca agassizi
Tubificoides n. sp. A	Paraonis n. sp. A
Aberranta enigmatica	Exogone hebes
Eudorella pusilla	Prionospio steenstrupi

TABLE H-4. DOMINANT SPECIES AT REGIONAL STATION 4 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Tellina agilis	Polygordius sp. A
Polygordius sp. A	Protohaustorius wigleyi
Protohaustorius wigleyi	Tellina agilis
Rhepoxynius hudsoni	Rhepoxynius hudsoni
Echinarachnius parma	Erichthonius rubricornis
Pseudohaustorius caroliniensis	Proceraea cornuta
Acanthohaustorius millsi	Palliolum sp. B
Spisula solidissima	Echinarachnius parma
Arctica islandica	Pseudohaustorius caroliniensis
Monoculodes edwardsi	Sthenelais limicola
M-3	**M-4**
Polygordius sp. A	Polygordius sp. A
Tellina agilis	Echinarachnius parma
Protohaustorius wigleyi	Protohaustorius wigleyi
Rhepoxynius hudsoni	Tellina agilis
Pseudohaustorius caroliniensis	Rhepoxynius hudsoni
Echinarachnius parma	Pseudohaustorius caroliniensis
Cirolana polita	Unciola inermis
Spisula solidissima	Nemertea sp. A
Nemertea sp. A	Proceraea cornuta
Tanaissus lilljeborgi	Erichthonius rubricornis
M-5	**M-6**
Polygordius sp. A	Polygordius sp. A
Protohaustorius wigleyi	Protohaustorius wigleyi
Tellina agilis	Tellina agilis
Echinarachnius parma	Rhepoxynius hudsoni
Rhepoxynius hudsoni	Pseudohaustorius caroliniensis
Sthenelais picta	Echinarachnius parma
Bivalve sp. F	Bivalve sp. F
Pseudohaustorius caroliniensis	Nemertea sp. A
Spiophanes bombyx	Spiophanes bombyx
Sthenelais limicola	Spisula solidissima
M-7	**M-8**
No Samples Collected	Polygordius sp. A
	Protohaustorius wigleyi
	Echinarachnius parma
	Rhepoxynius hudsoni
	Pseudohaustorius caroliniensis
	Tellina agilis
	Aglaophamus circinata
	Bivalve sp. F
	Nemertea sp. A
	Ceriantheopsis americanus

TABLE H-5. DOMINANT SPECIES AT REGIONAL STATION 5 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Erichthonius rubricornis	Exogone hebes
Exogone verugera	Sphaerosyllis cf. brevifrons
Unciola inermis	Exogone verugera
Exogone hebes	Erichthonius rubricornis
Sphaerosyllis cf. brevifrons	Peosidrilus biprostatus
Euclymene sp. A	Unciola inermis
Peosidrilus biprostatus	Euclymene sp. A
Parapionosyllis longicirrata	Tharyx acutus
Aricidea (Acmira) catherinae	Schistomeringos caeca
Tharyx sp. A	Tharyx sp. A
M-3	**M-4**
Exogone verugera	Sphaerosyllis cf. brevifrons
Sphaerosyllis cf. brevifrons	Exogone verugera
Exogone hebes	Exogone hebes
Parapionosyllis longicirrata	Unciola inermis
Peosidrilus biprostatus	Erichthonius rubricornis
Unciola inermis	Parapionosyllis longicirrata
Euclymene sp. A	Peosidrilus biprostatus
Aricidea (Acmira) catherinae	Aricidea (Acmira) catherinae
Tharyx acutus	Tharyx sp. A
Protodorvillea kefersteini	Tharyx acutus
M-5	**M-6**
Exogone verugera	Erichthonius rubricornis
Erichthonius rubricornis	Sphaerosyllis cf. brevifrons
Exogone hebes	Exogone hebes
Sphaerosyllis cf. brevifrons	Exogone verugera
Parapionosyllis longicirrata	Polygordius sp. A
Unciola inermis	Parapionosyllis longicirrata
Peosidrilus biprostatus	Peosidrilus biprostatus
Aricidea (Acmira) catherinae	Euclymene sp. A
Euclymene sp. A	Tharyx acutus
Tharyx sp. A	Aricidea (Acmira) catherinae
M-7	**M-8**
Erichthonius rubricornis	Erichthonius rubricornis
Sphaerosyllis cf. brevifrons	Sphaerosyllis cf. brevifrons
Exogone hebes	Exogone hebes
Parapionosyllis longicirrata	Unciola inermis
Peosidrilus biprostatus	Parapionosyllis longicirrata
Polygordius sp. A	Peosidrilus biprostatus
Euclymene sp. A	Aricidea (Acmira) catherinae
Tharyx acutus	Euclymene sp. A
Aricidea (Acmira) catherinae	Tharyx sp. A

TABLE H-6. DOMINANT SPECIES AT REGIONAL STATION 6 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Ampelisca agassizi	Ampelisca agassizi
Exogone hebes	Polygordius sp. A
Protodorvillea gaspeensis	Exogone hebes
Polygordius sp. A	Erichthonius rubricornis
Notomastus latericeus	Protodorvillea gaspeensis
Aglaophamus circinata	Notomastus latericeus
Tharyx acutus	Paraonis n. sp. A
Schistomeringos caeca	Aglaophamus circinata
Exogone verugera	Tharyx annulosus
Euchone hancocki	Laonice cirrata

M-3	M-4
Ampelisca agassizi	Ampelisca agassizi
Erichthonius rubricornis	Exogone hebes
Polygordius sp. A	Erichthonius rubricornis
Exogone hebes	Polygordius sp. A
Protodorvillea gaspeensis	Aglaophamus circinata
Notomastus latericeus	Protodorvillea gaspeensis
Paraonis n. sp. A	Notomastus latericeus
Chone duneri	Paraonis n. sp. A
Exogone verugera	Tubificoides n. sp. A
Lumbrineris latreilli	Lumbrineris latreilli

M-5	M-6
Ampelisca agassizi	Ampelisca agassizi
Exogone hebes	Erichthonius rubricornis
Protodorvillea gaspeensis	Polygordius sp. A
Notomastus latericeus	Exogone hebes
Aglaophamus circinata	Protodorvillea gaspeensis
Polygordius sp. A	Notomastus latericeus
Paraonis n. sp. A	Tubificoides n. sp. A
Tubificoides n. sp. A	Chone duneri
Lumbrineris latreilli	Lumbrineris latreilli
Unciola irrorata	Aglaophamus circinata

M-7	M-8
Ampelisca agassizi	Ampelisca agassizi
Erichthonius rubricornis	Exogone hebes
Exogone hebes	Protodorvillea gaspeensis
Protodorvillea gaspeensis	Euchone hancocki
Notomastus latericeus	Notomastus latericeus
Polygordius sp. A	Paraonis n. sp. A
Euchone hancocki	Aglaophamus circinata
Tubificoides n. sp. A	Chone infundibuliformis
Aglaophamus circinata	Tharyx annulosus
Chone duneri	Polygordius sp. A

TABLE H-7. DOMINANT SPECIES AT REGIONAL STATION 7 FOR SAMPLING CRUISES M-1 THROUGH M-4.

Station 7

M-1	M-2
Protodorvillea gaspeensis	Lumbrineris latreilli
Lumbrineris latreilli	Polygordius sp. A
Tharyx marioni	Chone duneri
Aricidea (Acmira) catherinae	Eclysippe sp. A
Aricidea (Allia) suecica	Phallodrilus tenuissimus
Paraonis n. sp. A	Aricidea (Acmira) neosuecica
Prionospio cirrifera	Protodorvillea gaspeensis
Aricidea (Acmira) neosuecica	Tharyx acutus
Tharyx acutus	Tharyx marioni
Polygordius sp. A	Aricidea (Acmira) catherinae

M-3	M-4
Golfingia minuta	Phallodrilus tenuissimus
Eclysippe sp. A	Eclysippe sp. A
Lumbrineris latreilli	Lumbrineris latreilli
Aricidea (Acmira) neosuecica	Protodorvillea gaspeensis
Protodorvillea gaspeensis	Tharyx marioni
Tharyx annulosus	Polycirrus sp. A
Tharyx marioni	Chone duneri
Chone duneri	Aricidea (Acmira) neosuecica
Polygordius sp. A	Aricidea (Acmira) catherinae
Phallodrilus tenuissimus	Polygordius sp. A
Tharyx acutus	

TABLE H-8. DOMINANT SPECIES AT REGIONAL STATION 7A FOR SAMPLING CRUISES M-5 THROUGH M-8.

M-5	M-6
Ampelisca agassizi	Aricidea (Allia) suecica
Cossura longocirrata	Ampelisca agassizi
Levinsenia gracilis	Cossura longocirrata
Aricidea (Allia) suecica	Levinsenia gracilis
Tubificoides n. sp. A	Tubificoides n. sp. A
Ninoe nigripes	Periploma papyratium
Terebillides stroemi	Lucinoma filosa
Aglaophamus circinata	Thyasira sp. B
Aricidea (Allia) quadrilobata	Ninoe nigripes
Ampharetidae n.g., n. sp. C	Tharyx annulosus
M-7	**M-8**
Ampelisca agassizi	Ampelisca agassizi
Levinsenia gracilis	Cossura longocirrata
Aricidea (Allia) suecica	Aricidea (Allia) suecica
Cossura longocirrata	Levinsenia gracilis
Tubificoides n. sp. A	Tubificoides n. sp. A
Lucinoma filosa	Ninoe nigripes
Periploma papyratium	Aricidea (Allia) quadrilobata
Ninoe nigripes	Periploma papyratium
Aricidea (Allia) quadrilobata	Lucinoma filosa
Thyasira sp. B	Ampharetidae n.g., n. sp. C

TABLE H-9. DOMINANT SPECIES AT REGIONAL STATIONS 8 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Ampelisca agassizi	Ampelisca agassizi
Tharyx nr. monilaris	Lumbrineris latreilli
Lumbrineris latreilli	Polygordius sp. A
Aricidea (Acmira) catherinae	Aricidea (Acmira) catherinae
Nierstrassia fragile	Chone duneri
Aricidea (Acmira) neosuecica	Tharyx marioni
Tharyx marioni	Aricidea (Acmira) neosuecica
Polycirrus sp. A	Tharyx nr. monilaris
Unciola irrorata	Nothria conchylega
Nereis grayi	Paraonis n. sp. A
M-3	**M-4**
Ampelisca agassizi	Ampelisca agassizi
Lumbrineris latreilli	Aricidea (Acmira) catherinae
Tharyx nr. monilaris	Paraonis n. sp. A
Polygordius sp. A	Lumbrineris latreilli
Aricidea (Acmira) catherinae	Tharyx marioni
Chone duneri	Tharyx nr. monilaris
Aricidea (Acmira) neosuecica	Paradoneis n. sp. A
Polycirrus sp. A	Aricidea (Acmira) neosuecica
Paraonis n. sp. A	Nothria conchylega
Nierstrassia fragile	Chone duneri
M-5	**M-6**
Ampelisca agassizi	Ampelisca agassizi
Lumbrineris latreilli	Tharyx marioni
Tharyx marioni	Aricidea (Acmira) catherinae
Aricidea (Acmira) catherinae	Lumbrineris latreilli
Chone duneri	Chone duneri
Paraonis n. sp. A	Aricidea (Acmira) neosuecica
Aricidea (Acmira) neosuecica	Chaetozone n. sp. B
Polycirrus sp. A	Paraonis n. sp. A
Nierstrassia fragile	Euchone hancocki
Nothria conchylega	Nierstrassia fragile
M-7	**M-8**
Ampelisca agassizi	Ampelisca agassizi
Lumbrineris latreilli	Aricidea (Acmira) catherinae
Tharyx marioni	Tharyx marioni
Aricidea (Acmira) catherinae	Lumbrineris latreilli
Nierstrassia fragile	Paraonis n. sp. A
Chaetozone n. sp. B	Aricidea (Acmira) neosuecica
Aricidea (Acmira) neosuecica	Chaetozone n. sp. B
Notomastus latericeus	Nierstrassia fragile
Nothria conchylega	Polycirrus sp. A
Paraonis n. sp. A	Notomastus latericeus

TABLE H-10. DOMINANT SPECIES AT REGIONAL STATIONS 9 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Ampelisca agassizi	Ampelisca agassizi
Protodorvillea gaspeensis	Polygordius sp. A
Aricidea (Acmira) catherinae	Protodorvillea gaspeensis
Paraonis n. sp. A	Aricidea (Acmira) catherinae
Peosidrilus biprostatus	Eclysippe sp. A
Eclysippe sp. A	Paraonis n. sp. A
Ampharetidae n.g., n. sp. A	Exogone hebes
Polygordius sp. A	Tubificoides n. sp. A
Euchone hancocki	Euchone hancocki
Tharyx nr. monilaris	Lumbrineris latreilli
M-3	**M-4**
Ampelisca agassizi	Ampelisca agassizi
Eclysippe sp. A	Protodorvillea gaspeensis
Aricidea (Acmira) catherinae	Aricidea (Acmira) catherinae
Polygordius sp. A	Eclysippe sp. A
Protodorvillea gaspeensis	Paraonis n. sp. A
Paraonis n. sp. A	Polygordius sp. A
Tubificoides n. sp. A	Lumbrineris latreilli
Tharyx marioni	Tharyx marioni
Myriochele sp. A	Tharyx annulosus
Lumbrineris latreilli	Euchone hancocki
M-5	**M-6**
Ampelisca agassizi	Ampelisca agassizi
Protodorvillea gaspeensis	Polygordius sp. A
Aricidea (Acmira) catherinae	Protodorvillea gaspeensis
Eclysippe sp. A	Eclysippe sp. A
Aricidea (Allia) suecica	Aricidea (Acmira) catherinae
Paraonis n. sp. A	Tubificoides n. sp. A
Nierstrassia fragile	Paraonis n. sp. A
Lumbrineris latreilli	Lumbrineris latreilli
Polygordius sp. A	Exogone verugera
Aglaophamus circinata	Tharyx annulosus
M-7	**M-8**
	Ampelisca agassizi
	Eclysippe sp. A
	Aricidea (Acmira) catherinae
	Protodorvillea gaspeensis
No Samples Collected	Paraonis n. sp. A
	Lumbrineris latreilli
	Tubificoides n. sp. A
	Tharyx annulosus
	Aglaophamus circinata
	Exogone naidena

TABLE H-11. DOMINANT SPECIES AT REGIONAL STATIONS 10 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Polygordius sp. A	Polygordius sp. A
Tanaissus lilljeborgi	Echinarachnius parma
Echinarachnius parma	Tanaissus lilljeborgi
Protohaustorius wigleyi	Rhepoxynius hudsoni
Exogone hebes	Protohaustorius wigleyi
Tellina agilis	Tellina agilis
Crangon septemspinosa	Exogone hebes
Rhepoxynius hudsoni	Paraonis n. sp. A
Streptosyllis varians	Spisula solidissima
Pseudunciola obliquua	Nemertea sp. A

M-3	M-4
Tanaissus lilljeborgi	Echinarachnius parma
Polygordius sp. A	Polygordius sp. A
Echinarachnius parma	Tanaissus lilljeborgi
Protohaustorius wigleyi	Exogone hebes
Rhepoxynius hudsoni	Rhepoxynius hudsoni
Exogone hebes	Protohaustorius wigleyi
Erichthonius rubricornis	Streptosyllis varians
Tellina agilis	Schistomeringos caeca
Streptosyllis varians	Tellina agilis
Nemertea sp. A	Grania n. sp. B

M-5	M-6
Tanaissus lilljeborgi	Polygordius sp. A
Echinarachnius parma	Tanaissus lilljeborgi
Polygordius sp. A	Echinarachnius parma
Spisula solidissima	Protohaustorius wigleyi
Paraonis n. sp. A	Rhepoxynius hudsoni
Spiophanes bombyx	Tellina agilis
Tellina agilis	Exogone hebes
Pseudunciola obliquua	Streptosyllis varians
Rhepoxynius hudsoni	Nemertea sp. A
Exogone hebes	Paraonis n. sp. A

M-7	M-8
Polygordius sp. A	Polygordius sp. A
Echinarachnius parma	Echinarachnius parma
Tanaissus lilljeborgi	Tanaissus lilljeborgi
Rhepoxynius hudsoni	Rhepoxynius hudsoni
Tellina agilis	Exogone hebes
Schistomeringos caeca	Protohaustorius wigleyi
Protodrilus sp. A	Paraonis n. sp. A
Protohaustorius wigleyi	Nemertea sp. A
Nemertea sp. A	Schistomeringos caeca
Aglaophamus circinata	Aglaophamus circinata

TABLE H-12. DOMINANT SPECIES AT REGIONAL STATION 11 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Tubificoides n. sp. A	Polygordius sp. A
Nucula proxima	Tubificoides n. sp. A
Aglaophamus circinata	Rhepoxynius hudsoni
Nucula delphinodonta	Spiophanes bombyx
Ninoe nigripes	Protodorvillea gaspeensis
Protodorvillea gaspeensis	Nucula proxima
Levensenia gracilis	Levensenia gracilis
Polygordius sp. A	Aglaophamus circinata
Rhepoxynius hudsoni	Peosidrilus biprostatus
Aricidea (Acmira) catherinae	Nucula delphinodonta
M-3	**M-4**
Polygordius sp. A	Polygordius sp. A
Levensenia gracilis	Aglaophamus circinata
Protodorvillea gaspeensis	Enchinarachnius parma
Tubificoides n. sp. A	Tubificoides n. sp. A
Nucula proxima	Ophelina acuminata
Spiophanes bombyx	Nucula proxima
Aglaophamus circinata	Scalibregma inflatum
Ninoe nigripes	Rhepoxynius hudsoni
Rhepoxynius hudsoni	Levensenia gracilis
Nucula delphinodonta	Protodorvillea gaspeensis
M-5	**M-6**
Erichthonius rubricornis	Polygordius sp. A
Aglaophamus circinata	Aglaophamus circinata
Polygordius sp. A	Tubificoides n. sp. A
Arctica islandica	Rhepoxynius hudsoni
Echinarachinius parma	Arctica islandica
Tubificoides n. sp. A	Protodorvillea gaspeensis
Ophelina acuminata	Tharyx acutus
Nucula proxima	Levensenia gracilis
Diastylis sculpta	Eudorella pusilla
Stenopleustes inermis	Nucula delphinodonta
M-7	**M-8**
	Aglaophamus circinata
	Diastylis quadrispinosa
	Tubificoides n. sp. A
	Erichthonius rubricornis
No Samples Collected	Arctica islandica
	Protodorvillea gaspeensis
	Levensenia gracilis
	Diastylis sculpta
	Eudorella pusilla
	Rhepoxynius hudsoni

TABLE H-13. DOMINANT SPECIES AT REGIONAL STATION 12 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1

Ampelisca agassizi
Polygordius sp. A
Ophelina cylindricaudata
Protodorvillea gaspeensis
Exogone hebes
Notomastus latericeus
Paraonis n. sp. A
Unciola irrorata
Aricidea (Allia) suecica
Aricidea (Acmira) catherinae

M-2

Ampelisca agassizi
Polygordius sp. A
Ophelina cylindricaudata
Protodorvillea gaspeensis
Notomastus latericeus
Paraonis n. sp. A
Exogene hebes
Aricidea (Allia) suecica
Aricidea (Acmira) catherinae
Unciola irrorata

M-3

Ampelisca agassizi
Polygordius sp. A
Ophelina cylindricaudata
Protodorvillea gaspeensis
Notomastus latericeus
Exogone hebes
Thyasira sp. D
Aricidea (Acmira) catherinae
Chone duneri
Paraonis n. sp. A

M-4

Ampelisca agassizi
Polygordius sp. A
Ophelina cylindricaudata
Protodorvillea gaspeensis
Exogone hebes
Exogone naidena
Notomastus latericeus
Aglaophamus circinata
Paraonis n. sp. A
Aricidea (Acmira) catherinae

M-5

Ampelisca agassizi
Ophelina cylindricaudata
Unciola irrorata
Exogone hebes
Protodorvillea gaspeensis
Polygordius sp. A
Notomastus latericeus
Aglaophamus circinata
Paraonis n. sp. A
Exogone naidena

M-6

Ampelisca agassizi
Polygordius sp. A
Exogone hebes
Protodorvillea gaspeensis
Ophelina cylindricaudata
Unciola irrorata
Notomastus latericeus
Aricidea (Acmira) catherinae
Chone duneri
Paraonis n. sp. A

M-7

No Samples Collected

M-8

Ampelisca agassizi
Unciola irrorata
Protodorvillea gaspeensis
Chone duneri
Ophelina cylindricaudata
Polygordius sp. A
Notomastus latericeus
Exogone hebes
Thyasira sp. B
Aricidea (Acmira) catherinae

TABLE H-14. DOMINANT SPECIES AT REGIONAL STATION 13 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Levinsenia gracilis	Cossura longocirrata
Tubificoides n. sp. A	Tubificoides n. sp. A
Cossura longocirrata	Levinsenia gracilis
Euchone incolor	Euchone incolor
Ninoe nigripes	Ninoe nigripes
Mediomastus fragilis	Ampelisca agassizi
Ampelisca agassizi	Mediomastus fragilis
Aricidea (Allia) suecica	Aricidea (Acmira) catherinae
Aricidea (Acmira) catherinae	Aricidea (Allia) suecica
Nucula proxima	Nucula proxima
M-3	**M-4**
Cossura longocirrata	Tubificoides n. sp. A
Levinsenia gracilis	Euchone incolor
Tubificoides n. sp. A	Levinsenia gracilis
Ampelisca agassizi	Cossura longocirrata
Euchone incolor	Ampelisca agassizi
Ninoe nigripes	Ninoe nigripes
Aricidea (Acmira) catherinae	Mediomastus fragilis
Mediomastus fragilis	Aricidea (Acmira) catherinae
Lumbrineris impatiens	Microphthalmus listensis
Aricidea (Allia) suecica	Aricidea (Allia) suecica
M-5	**M-6**
Cossura longocirrata	Cossura longocirrata
Euchone incolor	Levinsenia gracilis
Levinsenia gracilis	Tubificoides n. sp. A
Tubificoides n. sp. A	Ampelisca agassizi
Ninoe nigripes	Ninoe nigripes
Aricidea (Acmira) catherinae	Euchone incolor
Ampelisca agassizi	Aricidea (Acmira) catherinae
Mediomastus fragilis	Mediomastus fragilis
Nephtys incisa	Lumbrineris impatiens
Lumbrineris impatiens	Aricidea (Allia) suecica
M-7	**M-8**
Cossura longocirrata	Cossura longocirrata
Levinsenia gracilis	Levinsenia gracilis
Ampelisca agassizi	Tubificoides n. sp. A
Tubificoides n. sp. A	Ampelisca agassizi
Ninoe nigripes	Ninoe nigripes
Aricidea (Acmira) catherinae	Aricidea (Acmira) catherinae
Euchone incolor	Euchone incolor
Lumbrineris impatiens	Lumbrineris impatiens
Nephtys incisa	Aricidea (Allia) suecica
Mediomastus fragilis	Mediomastus fragilis

TABLE H-15. DOMINANT SPECIES AT REGIONAL STATION 13A FOR SAMPLING CRUISES M-5 THROUGH M-8.

M-5	M-6
Ampelisca agassizi	Ampelisca agassizi
Aricidea (Allia) suecica	Aricidea (Allia) suecica
Exogone verugera	Tharyx annulosus
Cossura longocirrata	Cossura longocirrata
Tharyx annulosus	Tubificoides n. sp. A
Tubificoides n. sp. A	Exogone verugera
Tharyx acutus	Myriochele sp. A
Euchone incolor	Protodorvillea gaspeensis
Terebellides stroemi	Terebellides stroemi
Protodorvillea gaspeensis	Tharyx acutus
M-7	**M-8**
No Samples Collected	Ampelisca agassizi
	Aricidea (Allia) suecica
	Cossura longocirrata
	Tubificoides n. sp. A
	Tharyx annulosus
	Myriochele sp. A
	Exogone verugera
	Protodorvillea gaspeensis
	Terebellides stroemi
	Harpinia propinqua

TABLE H-16. DOMINANT SPECIES AT REGIONAL STATION 14A FOR SAMPLING CRUISES M-5 THROUGH M-8.

M-5	M-6
Tharyx annulosus	Tharyx annulosus
Euchone incolor	Euchone incolor
Nuculana messanensis	Protodorvillea gaspeensis
Terebellides stroemi	Paradoneis lyra
Ophiura robusta	Terebellides stroemi
Protodorvillea gaspeensis	Cossura longicirrata
Ophiuroidea sp. H (juvenile)	Nuculana messanensis
Lumbrineris sp. C	Ophiura robusta
Paradoneis lyra	Lumbrineris sp. C
Spiophanes kroeyeri	Paramphinome jeffreysii

M-7	M-8
Tharyx annulosus	Tharyx annulosus
Euchone incolor	Euchone incolor
Terebellides stroemi	Protodorvillea gaspeensis
Nuculana messanensis	Paradoneis lyra
Protodorvillea gaspeensis	Terebellides stroemi
Cossura longicirrata	Nuculana messanensis
Thyasira sp. C	Lumbrineris sp. C
Ophelina abranchiata	Barantolla sp. A
Anobothrus gracilis	Anobothrus gracilis
Barantolla sp. A	Nemertea sp. A

TABLE H-17. DOMINANT SPECIES AT REGIONAL STATION 15 FOR SAMPLING CRUISES M-1 THROUGH M-4

M-1	M-2
Exogone hebes	Exogone hebes
Peosidrilus biprostatus	Spisula solidissima
Polygordius sp. A	Polygordius sp. A
Grania n. sp. A	Tanaissus lilljeborgi
Nemertea sp. B	Streptosyllis websteri
Streptosyllis websteri	Peosidrilus biprostatus
Parapionosyllis longicirrata	Grania n. sp. A
Syllides benedicti	Nemertea sp. C
Schistomeringos caeca	Parapionosyllis longicirrata
Caulleriella n. sp. B	Grania n. sp. C
M-3	**M-4**
Spisula solidissima	Echinarachnius parma
Tanaissus lilljeborgi	Exogone hebes
Exogone hebes	Spisula solidissima
Polygordius sp. A	Tanaissus lilljeborgi
Nemertea sp. E	Polygordius sp. A
Protohaustorius wigleyi	Scolelepis squamata
Aricidea (Acmira) catherinae	Nemertea sp. E
Caulleriella n. sp. B	Peosidrilus biprostatus
Syllides benedicti	Grania n. sp. A
Peosidrilus biprostatus	Exogone verugera

TABLE H-18. DOMINANT SPECIES AT REGIONAL STATION 16 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Paradoneis n. sp. A	Paradoneis n. sp. A
Peosidrilus biprostatus	Notomastus latericeus
Notomastus latericeus	Polycirrus sp. A
Tharyx nr. monilaris	Tharyx nr. monilaris
Protodorvillea gaspeensis	Peosidrilus biprostatus
Polycirrus sp. A	Tharyx marioni
Tharyx marioni	Polygordius sp. A
Aricidea (Allia) n. sp. A	Ampelisca agassizi
Exogone hebes	Aricidea (Acmira) catherinae
Ampelisca agassizi	Nierstrassia fragile

M-3	M-4
Paradoneis n. sp. A	Paradoneis n. sp. A
Polycirrus sp. A	Polycirrus sp. A
Notomastus latericeus	Peosidrilus biprostatus
Tharyx nr. monilaris	Notomastus latericeus
Peosidrilus biprostatus	Protodorvillea gaspeensis
Enteropneusta sp. E	Chone duneri
Ampelisca agassizi	Tharyx annulosus
Protodorvillea gaspeensis	Tharyx marioni
Tharyx marioni	Polygordius sp. A
Tharyx annulosus	Enteropneusta sp. E

M-5	M-6
Chone duneri	Chone duneri
Notomastus latericeus	Paradoneis n. sp. A
Paradoneis n. sp. A	Notomastus latericeus
Polycirrus sp. A	Polycirrus sp. F
Enteropneusta sp. E	Tharyx annulosus
Ampelisea agassizi	Aricidea (Acmira) neosuecica
Niestrassia fragile	Tharyx marioni
Lumbrineris latreilli	Enteropneusta sp. E
Tharyx marioni	Lumbrineris latreilli
Chaetozone n. sp. B	Chaetozone n. sp. B

M-7	M-8
Paradoneis n. sp. A	Paradoneis n. sp. A
Chone duneri	Chone duneri
Notomastus latericeus	Notomastus latericeus
Enteropneusta sp. E	Enteropneusta sp. E
Ampelisca agassizi	Ampelisca agassizi
Peosidrilus biprostatus	Tharyx marioni
Schistomeringos caeca	Tharyx annulosus
Tharyx annulosus	Lumbrineris latreilli
Nierstrassia fragile	Chaetozone n. sp. B
Polycirrus sp. F	Schistomeringos caeca

TABLE H-19. DOMINANT SPECIES AT REGIONAL STATION 17 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Paradoneis n. sp. A	Paradoneis n. sp. A
Aricidea (Acmira) catherinae	Polycirrus sp. A
Notomastus latericeus	Peosidrilus biprostatus
Peosidrilus biprostatus	Notomastus latericeus
Tharyx nr. monilaris	Tharyx nr. monilaris
Protodorvillea gaspeensis	Aricidea (Allia) n. sp. A
Thyasira sp. B	Polygordius sp. A
Schistomeringos caeca	Enteropneusta sp. E
Euchone incolor	Sphaerosyllis cf. brevifrons
Tharyx marioni	Chone infundibuliformis
M-3	**M-4**
Paradoneis n. sp. A	Paradoneis n. sp. A
Tharyx nr. monilaris	Notomastus latericeus
Peosidrilus biprostatus	Polycirrus sp. A
Notomastus latericeus	Tharyx marioni
Polycirrus sp. A	Peosidrilus biprostatus
Polygordius sp. A	Tharyx nr. monilaris
Tharyx marioni	Polygordius sp. A
Tharyx annulosus	Tharyx annulosus
Protodorvillea gaspeensis	Enteropneusta sp. E
Aricidea (Acmira) neosuecica	Polydora n. sp. C
M-5	**M-6**
Paradoneis n. sp. A	Paradoneis n. sp. A
Chone duneri	Chone duneri
Tharyx marioni	Notomastus latericeus
Notomastus latericeus	Polycirrus sp. F
Polycirrus sp. F	Tharyx marioni
Nierstrassia fragile	Nierstrassia fragile
Peosidrilus biprostatus	Scoloplos acmeceps
Aricidea (Acmira) neosuecica	Tharyx nr. monilaris
Enteropneusta sp. E	Peosidrilus biprostatus
Chaetozone n. sp. B	Aricidea (Acmira) neosuecica
M-7	**M-8**
Paradoneis n. sp. A	Paradoneis n. sp. A
Notomastus latericeus	Notomastus latericeus
Chone duneri	Chone duneri
Tharyx marioni	Tharyx marioni
Tubificoides n. sp. A	Polycirrus sp. F
Ampelisca agassizi	Enteropneusta sp. E
Enteropneusta sp. E	Aricidea (Acmira) neosuecica
Polycirrus sp. F	Spio cf. armata
Thyasira sp. B	Nierstrassia fragile
Aricidea (Acmira) neosuecica	Schistomeringos caeca

TABLE H-20. DOMINANT SPECIES AT REGIONAL STATION 18 FOR SAMPLING CRUISES M-1 THROUGH M-8.

M-1	M-2
Ampelisca agassizi	Ampelisca agassizi
Paraonis n. sp. A	Tharyx annulosus
Thyasira sp. B	Paraonis n. sp. A
Nierstrassia fragile	Aricidea (Acmira) neosuecica
Prionospio cirrifera	Aricidea (Acmira) catherinae
Lumbrineris latreilli	Tharyx nr. monilaris
Protodorvillea gaspeensis	Notomastus latericeus
Aglaophamus circinata	Enteropneusta sp. E
Aricidea (Acmira) neosuecica	Lumbrineris latreilli
Tharyx annulosus	Polygordius sp. A
M-3	**M-4**
Ampelisca agassizi	Ampelisca agassizi
Thyasira sp. B	Tharyx annulosus
Tharyx annulosus	Chaetozone n. sp. B
Aricidea (Acmira) catherinae	Lumbrineris latreilli
Paraonis n. sp. A	Tharyx nr. monilaris
Notomastus latericeus	Notomastus latericeus
Lumbrineris latreilli	Aricidea (Acmira) catherinae
Aricidea (Acmira) neosuecica	Prionospio cirrifera
Prionospio cirrifera	Paraonis n. sp. A
Polygordius sp. A	Aricidea (Acmira) neosuecica
M-5	**M-6**
Ampelisca agassizi	Ampelisca agassizi
Chaetozone n. sp. B	Chaetozone n. sp. B
Lumbrineris latreilli	Lumbrineris latreilli
Nierstrassia fragile	Thyasira sp. B
Thyasira sp. B	Enteropneusta sp. E
Unciola irrorata	Notomastus latericeus
Notomastus latericeus	Tharyx annulosus
Aricidea (Acmira) catherinae	Aricidea (Acmira) catherinae
Tharyx annulosus	Nierstrassia fragile
Aricidea (Acmira) neosuecica	Aricidea (Acmira) neosuecica
M-7	**M-8**
Ampelisca agassizi	Ampelisca agassizi
Notomastus latericeus	Notomastus latericeus
Tharyx annulosus	Chaetozone n. sp. B
Chaetozone n. sp. B	Aricidea (Acmira) neosuecica
Thyasira sp. B	Tharyx annulosus
Enteropneusta sp. E	Aricidea (Acmira) catherinae
Aricidea (Acmira) catherinae	Lumbrineris latreilli
Aricidea (Acmira) neosuecica	Thyasira sp. B
Lumbrineris latreilli	Tharyx marioni
Nierstrassia fragile	Enteropneusta sp. E

APPENDIX I

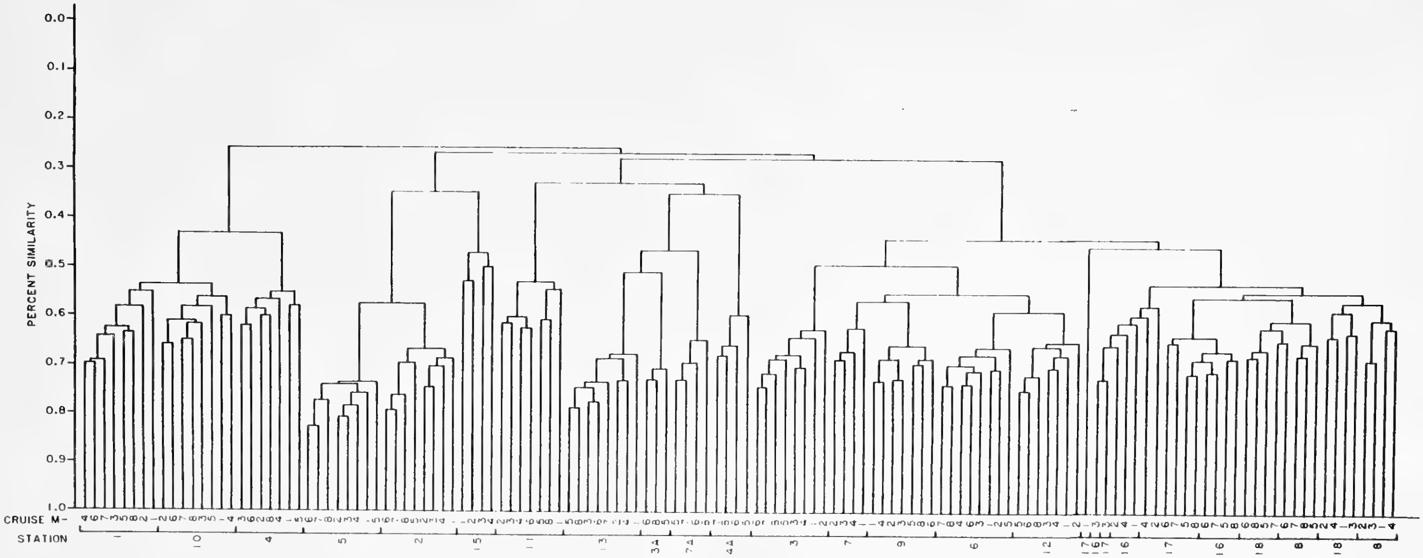


FIGURE I-1. SUMMED REPLICATES OF M1 THROUGH M8 REGIONAL STATIONS CLUSTERED BY PERCENT SIMILARITY AND GROUP AVERAGE SORTING. A FOURTH-ROOT TRANSFORMATION OF THE DATA WAS USED FOR THIS ANALYSIS.

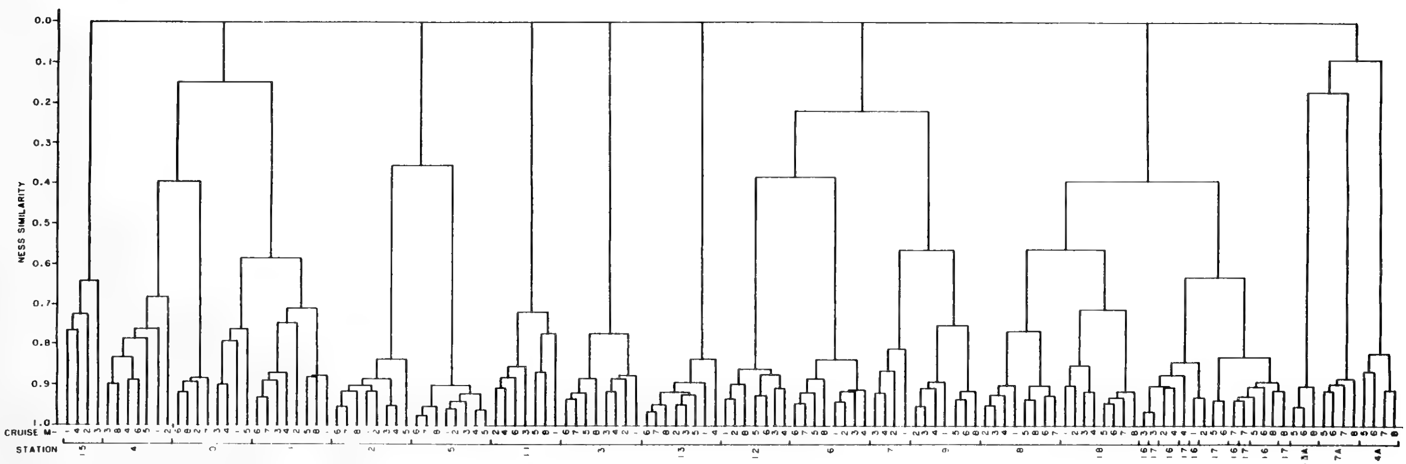


FIGURE I-2. SUMMED REPLICATES OF M1 THROUGH M8 REGIONAL STATIONS CLUSTERED BY NESS AT 200 INDIVIDUALS AND FLEXIBLE SORTING.

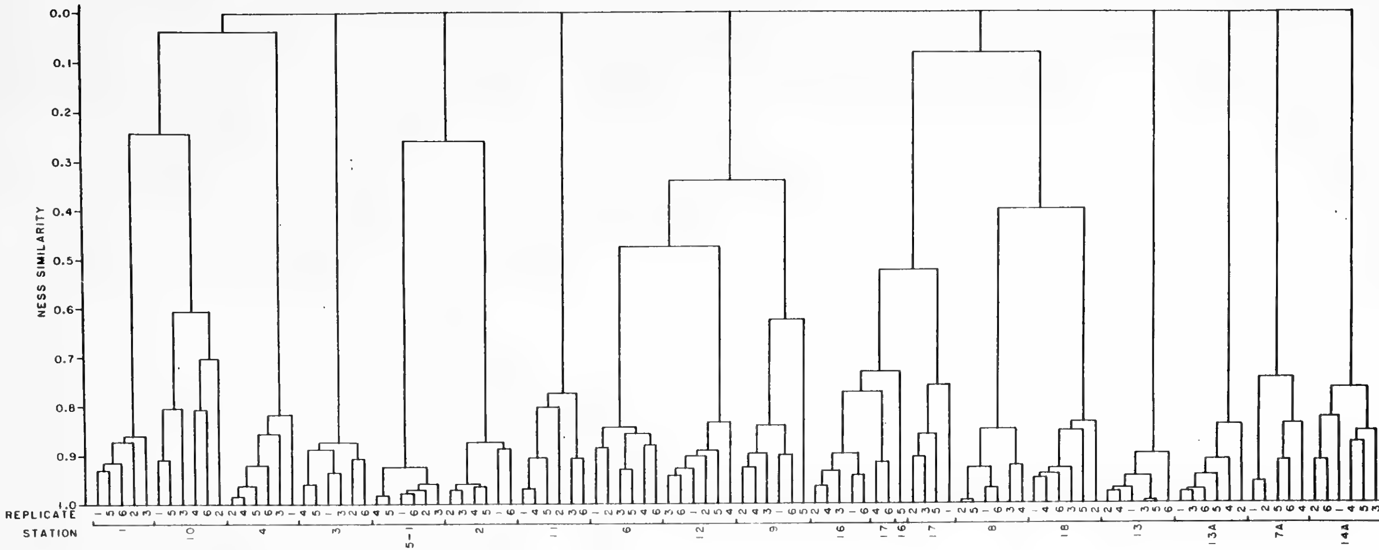


FIGURE I-3. M5 REPLICATES OF REGIONAL STATIONS CLUSTERED BY NESS AT 50 INDIVIDUALS AND FLEXIBLE SORTING.

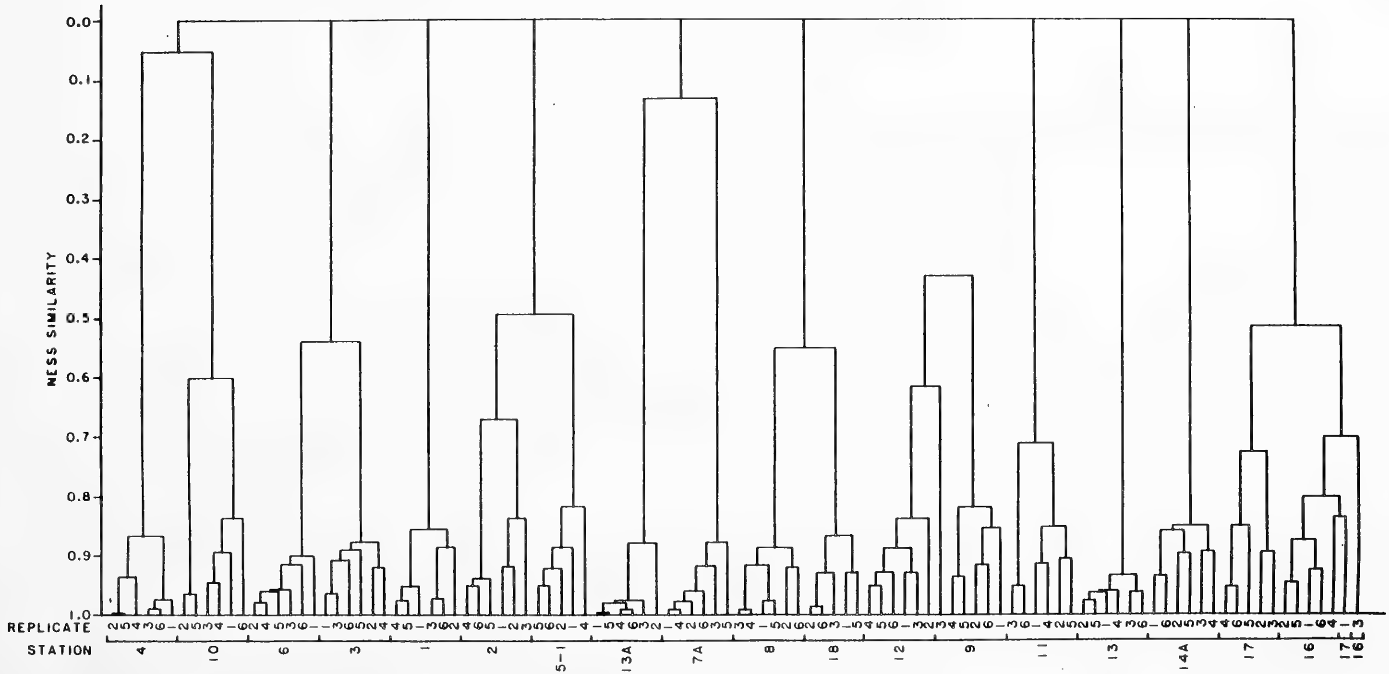


FIGURE I-4. M6 REPLICATES OF REGIONAL STATIONS CLUSTERED BY NESS AT 50 INDIVIDUALS AND FLEXIBLE SORTING.

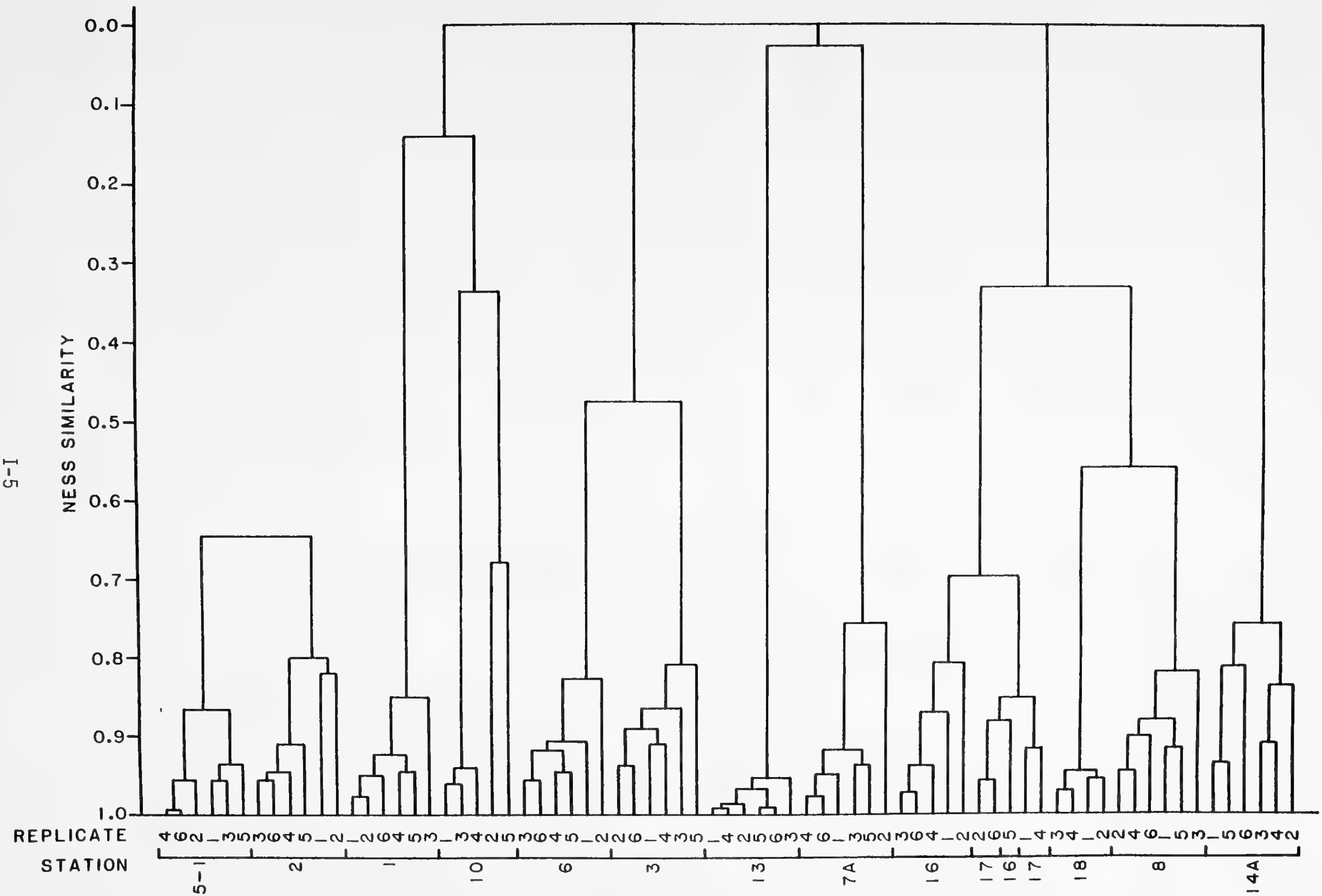


FIGURE I-5. M7 REPLICATES OF REGIONAL STATIONS CLUSTERED BY NESS AT 50 INDIVIDUALS AND FLEXIBLE SORTING.

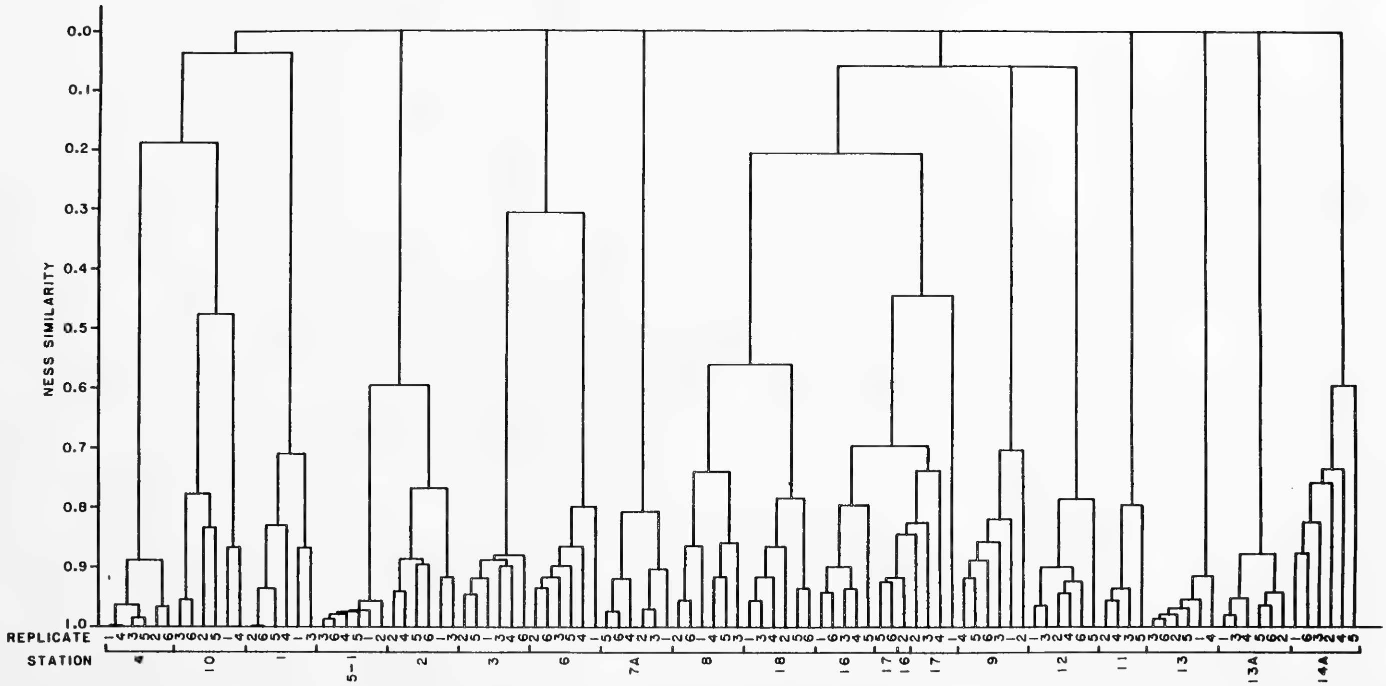


FIGURE I-6. M8 REPLICATES OF REGIONAL STATIONS CLUSTERED BY NESS AT 50 INDIVIDUALS AND FLEXIBLE SORTING.

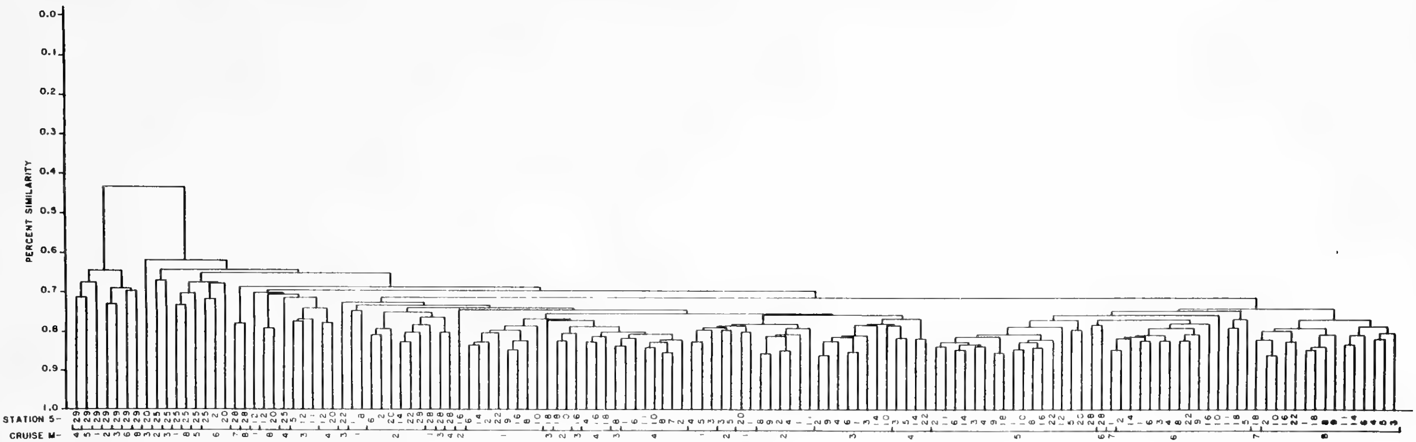


FIGURE I-7. SUMMED REPLICATES OF M1 THROUGH M8 SITE-SPECIFIC STATIONS CLUSTERED BY PERCENT SIMILARITY AND GROUP AVERAGE SORTING. A FOURTH-ROOT TRANSFORMATION OF THE DATA WAS USED FOR THIS ANALYSIS.

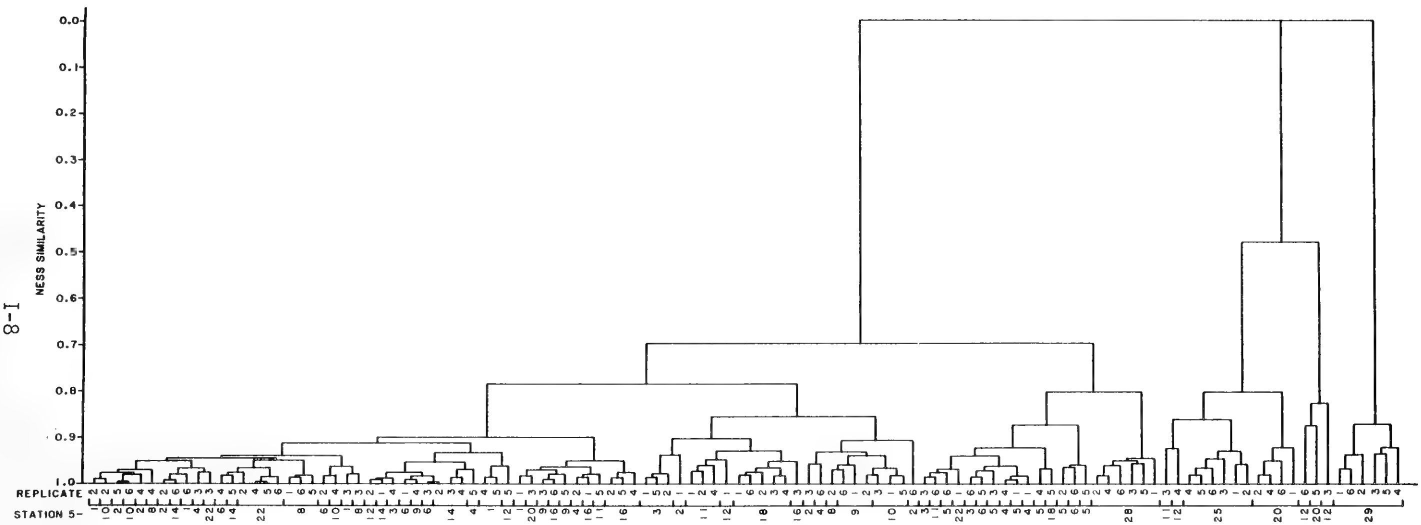


FIGURE I-8. M5 REPLICATES OF SITE-SPECIFIC STATIONS CLUSTERED BY NESS AT 50 INDIVIDUALS AND FLEXIBLE SORTING.

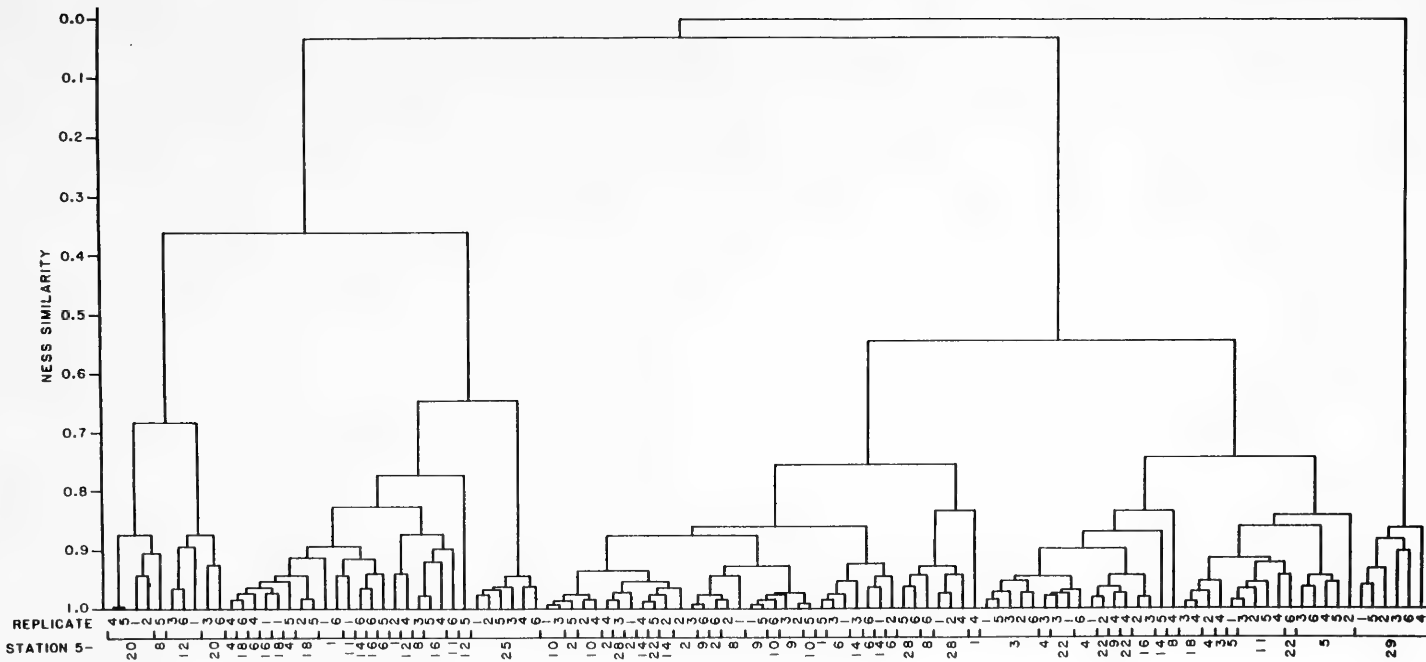


FIGURE I-9. M6 REPLICATES OF SITE-SPECIFIC STATIONS CLUSTERED BY NESS AT 50 INDIVIDUALS AND FLEXIBLE SORTING.

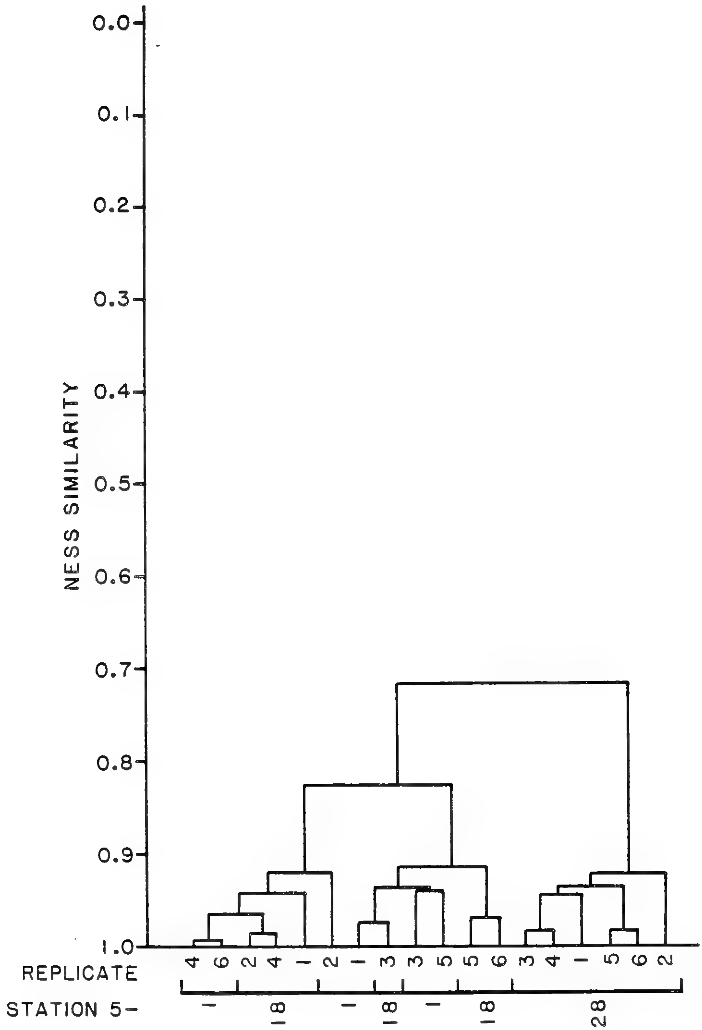


FIGURE I-10. M7 REPLICATES OF SITE-SPECIFIC STATIONS CLUSTERED BY NESS AT 50 INDIVIDUALS AND FLEXIBLE SORTING.

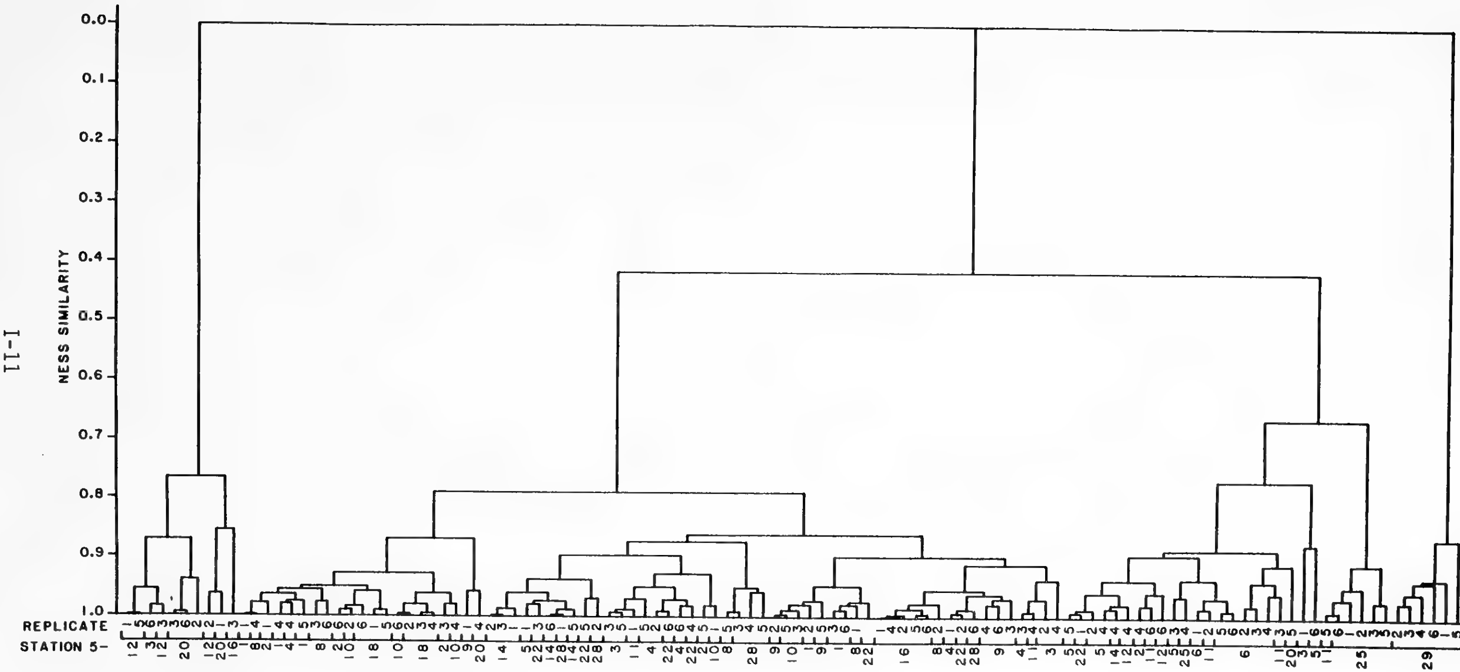


FIGURE I-11. M8 REPLICATES OF SITE-SPECIFIC STATIONS CLUSTERED BY NESS AT 50 INDIVIDUALS AND FLEXIBLE SORTING.